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Rev. 07/10/02

Hot Spot Areas 1,1A and 2
Work Plan
Revision 1

Enviro-Chem Site
Zionsville, Indiana

Prepared by

ENVIRON International Corporation
Northbrook, Illinois

December 1999

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We make Indiana a cleaner, healthier place to live

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VIA CERTIFIED MAIL Z 376 737 584

February 4, 2000

Mr. Mike McAteer
Remedial Project Manager
USEPA
Region 5 SR-6J
77 West Jackson Blvd.
Chicago, IL 60604-3590

Dear Mr. McAteer:

Re: Enviro-Chem Site
Zionsville, Indiana

The purpose of this letter is to correct some potential misrepresentations contained in a letter addressed to you from Dr. Roy Ball of ENVIRON, dated January 26, 2000.

ENVIRON originally faxed to me a question pertaining to clean closure criteria for groundwater at RCRA sites in Indiana. In response, I sent to ENVIRON the attached letter, which clearly indicates that the draft document *Risk Integrated System of Closure (RISC) - User's Guide,* dated February 18, 1999, ". . . may be utilized **when preparing a [RCRA] closure plan for IDEM approval."**

At no time did ENVIRON reference or mention the Enviro-Chem site, and my response was not meant to supercede or contradict any Record of Decision requirements at a CERCLA site.

In any event, the use of any *RISC* non-default (Tier 2 and/or Tier 3) risk assessment would require **IDEM** approval.

If I can be of further assistance in this matter, please call me at 317/232-3242.

Sincerely,

Victor P. Windle

Victor P. Windle, Chief
Hazardous Waste Permit Section
Office of Land Quality

cc: Roy Ball, ENVIRON
Norman Bernstein, Trustee
Myron Waters, IDEM
Catherine Gibbs, IDEM
Rex Osborn, IDEM
Steve Davis, IDEM

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January 3, 2000

Cynthia Bonczkiewicz
Environ
650 Dundee Road
Suite 150
Northbrook, Illinois 60062

Dear Ms. Bonczkiewicz:

Re: Groundwater Clean Closure Criteria
for RCRA Sites in Indiana

This letter is in response to your fax addressed to me, dated December 13, 1999. Your fax requests confirmation regarding the IDEM's RCRA clean closure criteria for groundwater.

Per your request, this letter will confirm that IDEM's RCRA clean closure criteria for groundwater can be found in the IDEM's Hazardous Waste Management Unit Closure Guidance (ID # WASTE-0013-NPD). Additionally, you may reference the draft guidance document entitled Risk Integrated System of Closure - *User's Guide*, dated February 18, 1999. At this time either document may be utilized when preparing a closure plan for IDEM approval.

I hope this letter is responsive to your request. If you have further questions, feel free to call me at 317 232-3242.

Sincerely,

Victor P. Windle

Victor P. Windle, Chief
Hazardous Waste Permit Section
Office of Land Quality

Review Comments on Environ's *Response to Hot Spots Areas 1, 1A and 2 Work Plan Comments* letter dated December 20, 1999

PREPARED FOR: Michael McAteer/U. S. EPA

PREPARED BY: Tim Harrison/CH2M HILL

COPIES: Al Erickson/CH2M HILL
Chris Greer/CH2M HILL

DATE: January 10, 2000

This memorandum presents CH2M HILL's review comments on the subject document. After reviewing the responses by the Enviro-Chem Trustees (Environ), CH2M HILL has the following comments:

In general, responses from the Enviro-Chem Trustees adequately addressed the questions and issues raised in CH2M HILL's original comments.

We continue to have questions about how the long-term effectiveness of the chemical oxidation treatment at the Hot Spot #2 will be confirmed (as discussed below).

We believe the Enviro-Chem Trustees should be urged to move forward with the activities proposed. In addition, the Trust should be urged to move forward on construction the RCRA cap over the southern end based on the results of the southern pad area exit sampling. The construction of the cap will need to be coordinated with the remediation of the Hot Spots.

With respect to monitoring the effectiveness of chemical oxidation at Hot Spot 2, it appears that the approach being proposed by the Enviro-Chem Trustees is based upon the observational technique. In short, the Enviro-Chem Trustees propose to take action (inject more oxidizing reagent), and observe the affect that action has on the groundwater conditions. If initial confirmation testing (3 weeks after each injection event), shows insufficient treatment, they propose to repeat the process up to 3 times before looking for alternatives. If initial confirmation testing shows sufficient treatment, they propose to be done.

The revised approach proposed for collecting the groundwater sample for confirmation testing addresses some concerns. They will add a new monitoring point for added coverage and information. In addition, removing the initial volume of reagent before sampling should help avoid sampling reagent. However, a time-related component remains a concern.

Our concern is that the VOC concentrations may increase with time (rebound), even if they appear to meet the criteria three weeks after one of the proposed injection events. This could result if the treatment/mixing is not complete for groundwater throughout the Hot Spot area.

Our understanding is that the agencies would like to have confidence that treatment has been effective in reducing VOC concentrations to acceptable level throughout Hot Spot area. We recommend that the EPA direct the Enviro-Chem Trust to sample the monitoring points within the hot spot area on a quarterly basis (or some other negotiated

frequency) for at least a year. The goal is to confirm that the treatment improves the conditions for the long term, not just the first 3 weeks.

Additional sampling should also be accomplished in conjunction with a discussion to move the Enviro-Chem Trustees forward on installing the cap over the southern end of the Enviro-Chem site.

ENVIRON

December 20, 1999

Mr. Michael McAteer
U.S. Environmental Protection Agency
Region 5, SR-6J
77 West Jackson Blvd
Chicago, IL 60604

RE: Response to Hot Spot Areas 1, 1A and 2 Work Plan Comments
Enviro-Chem Superfund Site, Zionsville, Indiana

Dear Mr. McAteer:

ENVIRON International Corporation, on behalf of the Enviro-Chem Trustees, has prepared the following response to the USEPA's and CH2M Hill's comments in your letter dated November 24, 1999. For the purpose of clarity, we have summarized each of CH2M Hill's comments (in boldface) immediately prior to our response.

SPECIFC COMMENTS

Page 5, Section A – Task 1 – Hot Spots Sampling

What period will elapse between the three consecutive purging events? Will each of the three wells be purged of 500 gallons, or is this number a total volume of water purged from the three wells (combined)?

Each well will be purged of 500 gallons or until dry. More specifically, if a well goes dry under continuous pumping prior to collecting 500 gallons of water, the well will be allowed to recharge for one hour prior to resuming pumping. If the well goes dry a second time prior to collecting 500 gallons of water, the well will be allowed to recharge for three hours prior to resuming pumping. Pumping will then cease upon either the well going dry or the collection of a total of 500 gallons from that well, whichever occurs first.

650 Dundee Road • Suite 150 • Northbrook, Illinois 60062 • USA • Tel: (847) 753-9900 • Fax: (847) 753-9420 • www.environcorp.com

The text indicates that the analytical results will be used as a baseline. Please describe how the baseline analytical results will be used. What steps are being taken to ensure that the analytical tests will produce results with appropriate detection limits so the data is usable?

The baseline analytical results will be used primarily to determine the initial volume and rate of the injection of the chemical oxidant as well as the need for pH adjustments and the addition of catalysts. In addition, the baseline analytical results will be used for comparison to treated test results to evaluate the treatment effectiveness.

We will use either a Contract laboratory Program Statement of Work or *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods* protocol to ensure that the proper Quality Assurance/Quality Control (QA/QC) is employed and appropriate detection limits are achieved for each sample.

Since this data is collected from soils/water from the Southern Pad Area (SPA), why will the analytical results be compared to the Table 3-1 criteria listed in the Consent Decree? Shouldn't results be compared to IDEM RCRA Clean Closure Criteria as was done for excavation of the SPA?

The data will be collected from the soils adjacent to and/or below the SPA. The purpose of the removal and data collection is to determine whether a cap needs to be extended to this area. Accordingly, the soil and water analytical results will be compared to the applicable IDEM RCRA Clean Closure Criteria.

Page 5 and 6, Section B - Task 2 - Hot Spot Area 2 Treatment (Chemical Oxidation)

The chemical oxidation process proposed for treating groundwater in HS-2 is expected to produce a zone of treated water with well HS-2 at its center. Explain how removing samples of water from HS-2 (the center of the zone of treated water) will show that the hot spot has been effectively treated? Also, please explain how the three-week period between sampling was selected. How much volume will be purged prior to sampling?

We will initially remove a volume equivalent to the volume of Fenton's reagent injected into well HS-2. Following this initial removal, the well will be allowed to recharge, and three well casing volumes will be purged prior to sample collection.

The three-week period between sampling was selected to allow sufficient time for the oxidation reaction to be completed, as well as to allow sufficient cooling time of both soil and water.

We are concerned that injection of Fenton's reagent into the ground may create a "sphere" of treated water that extends beyond the zone of influence of HS-2

during purging. Treatment of HS-2 may appear to be effective when contamination could remain beyond the "sphere" of influence. In our experience, Fenton's reagent is typically used when the extent of contamination has been well defined. Will further delineation or local down-gradient monitoring of HS-2 be considered?

We will initially remove a volume equivalent to the volume of Fenton's reagent injected into well HS-2. By removing a volume equivalent to the volume injected, the "sphere" of treated water will be effectively removed and representative samples will indicate the effectiveness of the treatment. As previously indicated, following the removal of the injected volume, the well will be allowed to recharge, and three well casing volumes will be purged prior to sample collection.

Past sampling events from the wells identified for confirmation testing have not shown concentration similar to those encountered in the Hot Spots. Please explain how they will be used to determine whether the Chemical Oxidation treatment process is effective. Why are these additional wells (T-8, T-9, S-2, and S-3) not sampled in the baseline?

A Geoprobe will be used to attempt to locate an observation well 10 to 20 feet south (downgradient) of Hot Spot 2. If the sand lens where well HS-2 is screened is present, a new well will be installed, screened across the lens. This observation well will be used for downgradient monitoring instead of T-8, T-9, S-2 and S-3, as originally proposed.

Since this data is collected from soils/water from the Southern Pad area (SPA), why will the analytical results be compared to the Table 3-1 criteria listed in the Consent Decree? Shouldn't results be compared to IDEM RCRA Clean Closure Criteria as was done for excavation of the SPA?

The soil and water analytical results will be compared to the applicable IDEM RCRA Clean Closure Criteria (refer to page 2 above).

Page 6 and 7, Section C- Task 3 – Hot Spot Areas 1,1A Delineation

Where is the area being considered for further delineation? How will the 12 to 16 locations for geoprobes be selected? Why are the geoprobes advanced to 22 feet? What is the minimum depth that needs to be reached to generate useful information? The concern is that the geoprobe will hit refusal before the sample point is deep enough to encounter the zones that contain concentrations of material being looked for.

The area considered for further delineation is presented in Figure 1 of Appendix F of the Work Plan, Versar's Preliminary Hot Spot Report. The Geoprobe locations will be selected around the estimated extent of the Hot Spot. If screening samples indicate that

elevated volatile concentrations are present, the Geoprobe boring locations will be stepped outwards.

Soil borings will be advanced to a maximum depth of 22 feet below ground surface (BGS) to maintain a minimum separation of 2 feet from the artesian sand and gravel formation, that is found at a depth of 24 to 25 feet BGS in this area. Based on the soil boring logs presented in Figure 2 of Appendix F of the Work Plan, the minimum depth that will generate useful information is 10 feet BGS. If the Geoprobe hits refusal prior to 22 feet BGS, a separate boring will be advanced in the vicinity of the initial boring until the desired depth is reached. Our experience with the site indicates that it is highly unlikely that refusal will be encountered.

For soil sampling, what "other" field screening tools will be used? What parameters are being analyzed and what methods are being utilized? The text indicates that "One sample from each boring will be submitted to the lab." Is that a composite sample or an interval sample with highest concentrations of compounds of concern?

The only field-screening tool to be used will be the photo-ionization detector (PID). One discrete sample will be selected from the interval exhibiting the highest PID-screened concentrations and submitted for laboratory analysis. Samples to be collected for laboratory analysis will be analyzed for volatile organic compounds using USEPA's *Test Methods for Evaluating Solid Waste – Physical/Chemical Methods, SW-846*, Method 8260.

Page 7 and 8, Section D- Task 4 – Hot Spots 1,1A Contaminated Soil Excavation

What evaluation process and criteria were used to decide that soil should be excavated from HS areas 1 and 1A? What are the goals that excavating and treating soil will meet? Why excavate in this area and not at HS-2? Why not use some other treatment process on the soils at this location?

The first criterion used in the decision-making process was the observation that after three Fenton's reagent injection events, the residual concentrations following injection remained relatively high at Hot Spot 1, 1A. The second criterion was the Hot Spot 1, 1A volume, estimated to be approximately 100 cubic yards, as shown in Figure 1 of Appendix F of the Work Plan. Based in the estimated volume of Hot Spot 1, 1A, it was decided that excavation and *ex-situ* soil vapor extraction was the alternative of choice.

The soil analytical results will be compared to the applicable IDEM RCRA Clean Closure Criteria (refer to page 2 above).

We did not propose to excavate at Hot Spot 2 because following the Fenton's reagent injection, the residual concentrations at Hot Spot 2 were relatively low. In addition,

artesian conditions are closer to the ground surface in this area. Therefore, we believe that additional Fenton's reagent injection will achieve the goal.

No other treatment processes were identified that appear to have higher probability of success for the Hot Spots than those proposed.

What criteria will be used for determining the extent of excavation (before and during excavation)? What methods of sampling and QA/QC will be utilized to ensure these goals are met? What criteria need to be met before digging can stop?

Prior to the excavation, the extent will be defined based on the PID and laboratory analytical results. During the excavation activities, PID headspace readings, field observations and engineering judgement will be used to define the final excavation limits (the PID will be standardized on a daily basis using isobutylene calibration gas). The factors to be considered for termination of the excavation include PID headspace readings, field observations and engineering judgement. At the completion of the excavation, bottom and sidewall samples will be collected every 20 feet and sent to a laboratory. Samples to be collected for laboratory analysis will be analyzed for volatile and semivolatile organic compounds using USEPA's *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846,* Method 8260 and Method 8270, respectively. All appropriate QA/QC protocols will be followed by the laboratory. Samples to be analyzed for volatile organic compounds will be collected using Method 5035.

What is the purpose of collecting the bottom sample data? What decisions will be made with the results? What about sidewall samples?

The bottom samples analytical data will define the residual concentrations, if any, that will remain because of the artesian conditions present in the sand and gravel formation. Also as indicated previously, the analytical results for both the bottom and sidewall samples will be compared to the applicable IDEM RCRA Clean Closure Criteria to determine whether or not a cap extension is needed in this area.

Given that artesian conditions may be present, will dewatering be required for the excavation? If so, how will the water be handled and disposed of?

As indicated in the Work Plan, removal of water from the sand lenses present at the site is anticipated. Water that is removed will be placed in fractionation tanks. The fractionation tanks will be sampled to determine if the water is suitable for on-site treatment prior to pumping into the water treatment system.

Page 8, Section E – Task 5 – Treatment of Excavated Soil

What is the goal for treating the excavated soil? What criteria will be used to decide that the soil vapor extraction is complete? What will happen if the SVE is not effective at treating the soil?

The soil analytical results will be compared to the applicable IDEM RCRA Clean Closure Criteria as a goal (refer to page 2 above).

SVE will be considered complete when vapor levels are commensurate with the applicable IDEM RCRA Clean Closure Criteria using the procedures outlined in Appendix D of the Revised Exhibit A of the Consent Decree.

Based on the performance of the SVE system at the Enviro-Chem site, this contingency (i.e., SVE not being effective) is not anticipated. If, however, SVE is not complete, the excavated soil will be treated to at least the criteria of Table 3-1 of the Revised Exhibit A.

If the soil is successfully treated to the applicable IDEM RCRA Clean Closure Criteria then a cap over these soils will not be required. If soil is not successfully treated to the applicable IDEM RCRA Clean Closure Criteria, a cap will be required over these soils.

What mechanism will be used to decontaminate equipment if the decontamination pad is used to treat soil as proposed? Is the decontamination pad designed adequately for this use? Is there significant excess storage capacity if more soil must be excavated than predicted?

During the excavation activities, a temporary decontamination pad for equipment will be constructed as needed on the support zone near the excavation area. Once the excavation activities are complete, this temporary decontamination pad will be dismantled and decontaminated by triple rinsing. The rinsate will be discharged to the site water treatment system. The decontaminated pad liner will be disposed of off site as a solid waste in accordance with applicable regulations.

The permanent decontamination pad provides an excellent solution for the temporary containment of soil while contaminated vapor is extracted. The advantages of using the decontamination pad include reinforced concrete construction, containment walls on two sides and bermed ramps on the other two sides. An additional advantage of employing the permanent decontamination pad is a built in sump and appropriate floor slope, which provide for drainage and fluid containment and recovery.

The permanent decontamination pad can accommodate approximately 200 cubic yards of excavated soil, approximately 100 percent over the minimum estimated amount of soil to be excavated at Hot Spot 1, 1A. In the unlikely event that the excavated soil exceeds the capacity of the permanent decontamination pad, then the permanent

decontamination pad could be temporarily extended into the support zone. Once the vapor extraction of the removed soils is ended, the temporary decontamination pad extension, if any, will be decontaminated and disposed of using the same procedures as used for the temporary decontamination pad in the support zone.

What criteria will be used to determine that soil is adequately treated to allow placement on the ground as opposed to under a cap like other areas of the site?

The soil analytical results will be compared to the applicable IDEM RCRA Clean Closure Criteria (refer to page 2 above).

If you have any questions, please feel free to contact me at (847) 753-9900.

Sincerely,

ENVIRON International Corporation

Ronald E. Hutchens, P.E.
Principal

REH:als
P:\ECC\Word Files\McAteer_122099ltr.doc

Enclosure

cc: Myron Waters - IDEM
Tim Harrison - CH2M
Norman W. Bernstein - N.W. Bernstein & Associates, LLC
Roy O. Ball, Ph.D., P.E. - ENVIRON International Corporation

CONTENTS

FIGURES

APPENDICIES

I. INTRODUCTION

This is a Work Plan for the investigation, removal and remediation of additional contamination (i.e., Hot Spot Areas 1, 1A, and 2) in the vicinity of the Environmental Conservation and Chemical Corporation (ECC) Superfind site.

A. Site Description

The ECC site is in a rural area of Boone County, approximately 5 miles North of Zionsville, and 10 miles Northwest of Indianapolis, Indiana. A site location map of the ECC site is provided in Figure 1. A Site Layout Map is provided in Figure 2. A detailed map of the former Southern Concrete Pad that includes the Hot Spot Wells is provided in Appendix A as part of the Hot Spot Work Plan prepared by Versar, Inc. (Versar), dated March 1998.

B. Background

During the advancement of Versar's geotechnical survey borings on the former Southern Concrete Pad of the ECC site (G-1 through G-18), high concentrations of organic compounds were discovered in borings G-17 and G-18. Due to the presence of organic materials, an investigative study was conducted, and a Work Plan was prepared and implemented by Versar (included as Appendix A). During further excavation of the Southern Concrete Pad, residual organic material was discovered at the southeastern corner at approximately 11 feet in depth. This new area was denoted as Hot Spot Area 2, and the removal and treatment of residual material from this area was addressed in the Revised Hot Spot #2 Work Plan, dated October 7, 1998 (Appendix B).

C. Investigation and Treatment History

Following the discovery of Hot Spot Area 1, 1A, a test boring (i.e., TB-1) was advanced to determine the underlying stratigraphy of the immediate area. It was concluded by Versar that a Fenton Reagent injection would be the appropriate method

of treatment for the "Hot Spot". Four additional wells (i.e., IW-1 through IW-4) were installed for the purpose of groundwater withdrawal, and Fenton Reagent injection treatment. During the installation of these wells it was discovered that only IW-1 and IW-4 had penetrated the contaminated sand lens. IW-1 was screened at the upper level of Hot Spot Area 1, 1A, and IW-4 was screened at lower levels. Wells IW-2 and I-W3 were grouted to the surface in accordance with the Indiana Department of Environmental Management (IDEM) guidelines. Boring logs for wells HS-1, HS-1A, HS-2, IW-4 and surrounding wells are provided in Appendix C.

Versar injected Hot Spot Area 1,1A with Fenton Reagent on three occasions - in April, May and December 1998. After the discovery of Hot Spot Area 2 and the installation of well HS-2, this area was injected in December 1998.

D. Results

Task # 4 of Versar's Hot Spot Work Plan (Appendix A) included a Pilot Study. The results of this study are provided in Appendix D.

Appendix E presents a summary of the analytical results for the samples collected from the injection and monitoring prior to and following the Fenton Reagent injections performed on Hot Spot Areas 1, 1A and 2. The first round of oxidant injection conducted at Hot Spot Area 1, 1A showed promising reduction of the compounds of concern, although the Acceptable Subsurface Water Concentration criteria outlined in Table 3-1 of Exhibit A, Revision 2 ("Revised Exhibit A") or IDEM RCRA Clean Closure Criteria were not met. Subsequent injections by Versar in Hot Spot Area 1, 1A proved inconclusive due to high detection limits (i.e., due to high dilution ratios) by the laboratory. The analytical results of water samples collected prior to and following the Fenton Reagent injection of well HS-2 at Hot Spot Area 2 showed significant reduction of the contaminants of concern, although the criteria in Revised Exhibit A were not achieved, it appears that an additional application of oxidant at the Hot Spot Area 2 may well achieve the criteria.

E. Geology/Hydrogeology

The geology of the area near the Southern Concrete Pad, characterized by glacially deposited sediments, is very heterogeneous consisting of sorted sand and gravel layers of varying thickness. The lithographic layers that reside in the Hot Spot Area can be broken down into four distinct categories:

1. A Disturbed Grey and Brown Clay/Silt

This layer exhibited chemical odor in some areas, and contained some decaying plant matter that appeared to be relatively recent in age;

2. Gray Clay and Silt

This material was layered intermittently with the brown sand layers and was relatively dry suggesting that it was an impermeable layer;

3. Brown Sand and Gravel

This material was intermittently layered between the gray clay and silt material, and was found to be saturated. This layer was not continuous, but was believed to be the lens (pathway) in transporting organic materials; and

4. Brown Gravel

This material was only encountered in drilling IW-3, and was composed of fine to coarse angular and rounded gravel that was non-continuous and associated with the lower sand units.

In the Hot Spot Area 1, 1A it appears that the saturated sand and gravel layers aided in the transport of organics, and the clay/silt layers that were relatively dry, acted as the confining layers. The water table in IW-1 stabilized at 10 feet, which correlates to the brown sand and gravel layer. The water table in IW-4 stabilized at 18.5 feet also in the brown sand and gravel layer. A geologic cross-section of the Hot Spot Area 1, 1A that includes surrounding well depths and screen placement is provided in Figure 3.

An additional geologic cross-section was created by Versar for the Preliminary Hot Spot Report (Appendix F).

In accordance with Versar's Hot Spot #2 Work Plan, a 120-hour pumping test was conducted on the HS-2 well. For the duration of the test, groundwater elevations were monitored in HS-2, HS-1 and HS-1A as well as surrounding wells S-2, S-3, T-9 and IW-5. A copy of the pumping test results is provided in Appendix G.

II. SCOPE OF WORK

The outline of work to be performed by the Contractor is divided into six separate tasks, which are summarized as follows:

A. Task 1 - Hot Spots Sampling

- Prior to sampling, 500 gallons (or until dry for three consecutive events in one day) will be purged from each of wells HS-1, HS-1A and HS-2. More specifically, if a well goes dry under continuous pumping prior to collecting 500 gallons of water, the well will be allowed to recharge for one hour prior to resuming pumping. If the well goes dry a second time prior to collecting 500 gallons of water, the well will be allowed to recharge for three hours prior to resuming pumping. Pumping will then cease upon either the well going dry or the collection of a total of 500 gallons from that well, whichever occurs first. Purge water collected will be placed in on-site fractionation tanks. These tanks will be sampled and analyzed prior to pumping into the on-site water treatment system to determine if the water is suitable for on-site treatment.
- Purge water will only be discharged into the on-site system following receipt of analytical results and approval by the ECC Trustees' representative.
- Following the Hot Spot wells purging, samples from wells HS-1, HS-1A and HS-2 will be collected and analyzed. The analyses required will be for the compounds listed in Table 3-1 of Revised Exhibit A. The results from the samples collected will be used to establish a baseline. The baseline analytical results will be used primarily to determine the initial volume and rate of the injection of the chemical oxidant as well as the need for pH adjustments and the addition of catalysts. In addition, the baseline analytical results will be used for comparison to treated test results to evaluate the treatment effectiveness.

- A Contract laboratory Program Statement of Work or *Test Methods for Evaluating Solid Waste – Physical/Chemical Methods, SW-846* protocol will be used to ensure that the proper Quality Assurance/Quality Control (QA/QC) is employed and appropriate detection limits are achieved for each sample.
- The ECC Trustees will provide a report detailing the baseline analytical results to the U.S. Environmental Protection Agency (USEPA), IDEM and CH2M Hill. The water (and soil) analytical results will be compared to the applicable IDEM RCRA Clean Closure Criteria.

B. Task 2 – Hot Spot Area 2 Treatment (Chemical Oxidation)

- A Geoprobe will be used to attempt to locate an observation well 10 to 20 feet south (downgradient) of Hot Spot 2. If the sand lens where well HS-2 is screened is present, a new well will be installed, screened across the lens.
- Prior to the injection of chemical oxidant into Hot Spot Area 2, the necessary volume and rate of injection of chemical oxidant (and pH adjustment and/or buffering agents, and catalysts, if necessary) will be determined.
- The selected treatment chemical or chemical reagent mixture will be injected into Hot Spot well HS-2.
- Approximately three weeks after the injection of the chemical oxidant, water samples will be collected and analyzed for VOCs.
- A volume equivalent to the volume of Fenton's reagent injected into well HS-2 will be initially removed. Following this initial removal, the well will be allowed to recharge, and three well casing volumes will be purged prior to sample collection.
- If the analytical results do not meet the applicable IDEM RCRA Clean Closure Criteria, the treatment process will be repeated up to two additional times. If after three *in-situ* chemical oxidation treatment events, the samples have not met the applicable IDEM RCRA Clean Closure Criteria, the ECC Trustees will review other available options for Hot Spot Area 2.

- When the analytical results meet the applicable IDEM RCRA Clean Closure Criteria, a letter report summarizing the results and their comparison to the criteria will be provided.
- When the analytical results confirm that the applicable IDEM RCRA Clean Closure Criteria have been met, well HS-2 will be abandoned in accordance with IDEM requirements.

C. Task 3 - Hot Spot Areas 1, 1A Delineation

- A Geoprobe investigation at 12 to 16 locations in the vicinity of wells HS-1 and HS-1A will be conducted to a maximum depth of 22 feet, or until refusal, whichever occurs first. The area considered for further delineation is presented in Figure 1 of Appendix F.
- Soil borings will be advanced to a maximum depth of 22 feet below ground surface (BGS) to maintain a minimum separation of 2 feet from the artesian sand and gravel formation, that is found at a depth of 24 to 25 feet BGS in this area. Based on the soil boring logs presented in Figure 2 of Appendix F, the minimum depth that will generate useful information is 10 feet BGS. If the Geoprobe hits refusal prior to 22 feet BGS, a separate boring will be advanced in the vicinity of the initial boring until the desired depth is reached.
- If the artesian aquifer is penetrated shallower than 22 feet, the boring will be abandoned immediately using a tremie pipe injecting bentonite slurry.
- Soil samples will be continuously collected from each soil boring and field-screened using a photoionization detector (PID). One discrete sample will be selected from the interval exhibiting the highest PID-screened concentrations and submitted for laboratory analysis. Samples to be collected for laboratory analysis will be analyzed for volatile organic compounds using USEPA's *Test Methods for Evaluating Solid Waste – Physical/Chemical Methods, SW-846,* Method 8260.
- The sampling locations and elevations will be surveyed by an Indiana certified surveyor using State Plain Coordinates and the U.S. Datum mean sea level.

Each of the Geoprobe boring locations will be marked in the field and surveyed after completion.

- Once the Geoprobe borings have been completed, a geologic cross-section of the Hot Spot Areas 1, 1A will be developed using the historical and newly obtained information. After receipt of the laboratory analytical results, the field and analytical results will be compiled and the area and depth to be excavated will be determined.
- A letter report discussing the results and the extent to be excavated will be submitted. The sampling locations will be plotted on the site base map, which will be included in the report.

D. Task 4 - Hot Spot 1, 1A Contaminated Soil Excavation

- Current estimates indicate that approximately 100 cubic yards may need to be excavated in the vicinity of wells HS-1 and HS-1A, respectively.
- Due to the heterogeneous sidewalls, de-watering may be required if water bearing sand seams are encountered. Water collected from the pit will be placed in on-site fractionation tanks. These tanks will be sampled prior to pumping into the water treatment system to determine if the water is suitable for on-site treatment.
- At the completion of the excavation, bottom and sidewall samples will be collected every 20 feet and sent to a laboratory. Samples to be collected for laboratory analysis will be analyzed for volatile and semivolatile organic compounds using USEPA's *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846,* Method 8260 and Method 8270, respectively. Samples to be analyzed for volatile organic compounds will be collected using Method 5035.
- The bottom samples analytical data will define the residual concentrations, if any, that may remain because of practical limits on the depth of excavation due to artesian conditions present in the sand and gravel formation. The analytical results for both the bottom and sidewall samples will be compared to

the applicable IDEM RCRA Clean Closure Criteria to determine whether or not a cap extension is needed in this area.

- The excavation pit will be backfilled with Suitable Fill, as defined in the 100% Revised Remedial Action (RRA) Design. The backfill will be compacted to grade by remote means.
- A report summarizing the confirmatory samples results will be prepared and submitted.

E. Task 5 - Treatment of Excavated Soil

- On-site treatment of the excavated soil from Hot Spot 1, 1A will consist of *ex-situ* soil vapor extraction (SVE) using the excess capacity currently available on the on-site SVE system. It is currently estimated that approximately 100 cubic yards will be treated, with ready capacity of 200 cubic yards.
- A drainage grid will be prepared on the decontamination pad located on the northwest portion of the site, and the excavated soils will be placed on the grid.
- During the excavation activities, a temporary decontamination pad for equipment will be constructed as needed on the support zone near the excavation area. Once the excavation activities are complete, this temporary decontamination pad will be dismantled and decontaminated by triple rinsing. The rinsate will be discharged to the site water treatment system. The decontaminated pad liner will be disposed of off site as a solid waste in accordance with applicable regulations.
- The permanent decontamination pad can accommodate approximately 200 cubic yards of excavated soil, approximately 100 percent over the minimum estimated amount of soil to be excavated at Hot Spot 1, 1A. In the unlikely event that the excavated soil exceeds the capacity of the permanent decontamination pad, then the permanent decontamination pad could be temporarily extended into the support zone. Once the vapor extraction of the removed soils is ended, the temporary decontamination pad extension, if any,

will be decontaminated and disposed of using the same procedures as used for the temporary decontamination pad in the support zone.

- Perforated 2-inch PVC piping will be laid horizontally in layers within the soil. One 6-inch PVC manifold will be used to branch into the PVC perforated pipes with isolation valves. Pressure gauges with flow measurement ports (Magnehelic differential pressure measurements) will also be provided.
- The entire soil pile will be covered with heavy plastic sheeting.
- Following connection of the temporary 6-inch manifold to the SVE system, the airflows in the excavated soils will be balanced.
- Water from the soil and rainwater will be collected in the decontamination pad sump. Collected water will be placed in on-site fractionation tanks. These tanks will be sampled prior to pumping into the water treatment system to determine if the water is suitable for on-site treatment.
- SVE will be considered complete when vapor levels are commensurate with the applicable IDEM RCRA Clean Closure Criteria using the procedures outlined in Appendix D of the Revised Exhibit A of the Consent Decree.
- Once laboratory analysis confirms the completion of the SVE, the treated soil will be spread on the southern portion of the site, south of the RCRA cap, to a depth of approximately one-foot.
- If, however, the soil cannot be successfully treated to the applicable IDEM RCRA Clean Closure Criteria, then the soil will be treated to at least the criteria of Table 3-1 of the Revised Exhibit A and be located on an area where a cap can be placed over them.
- The treated soil application area will be covered with topsoil and seeded.

F. Health, Safety and Quality Assurance

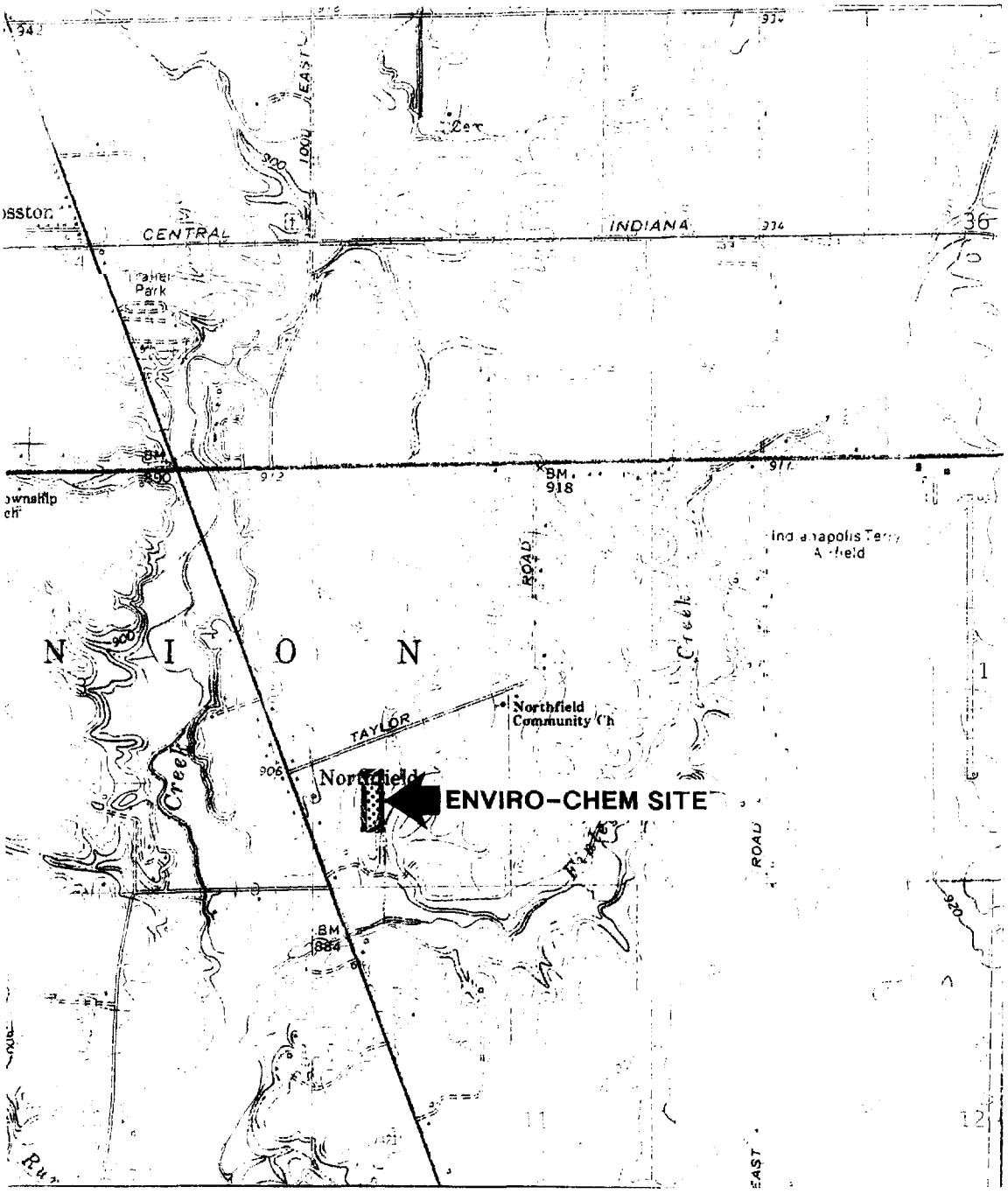
All work will be performed in accordance with the approved RRA Health and Safety Plans and Quality Assurance Project Plans. As part of the analytical quality

assurance, care will be taken to ensure that the laboratory detection limits are below the applicable IDEM RCRA Clean Closure Criteria.

III. REPORTING

Once all the above tasks have been completed, a comprehensive report summarizing the scope of the work achieved, including supporting documentation, will be submitted to the USEPA, IDEM and CH2M Hill.

FIGURES



SCALE 1: 24000

1 1/2 0 1 MILE

2000 0 2000 4000 6000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

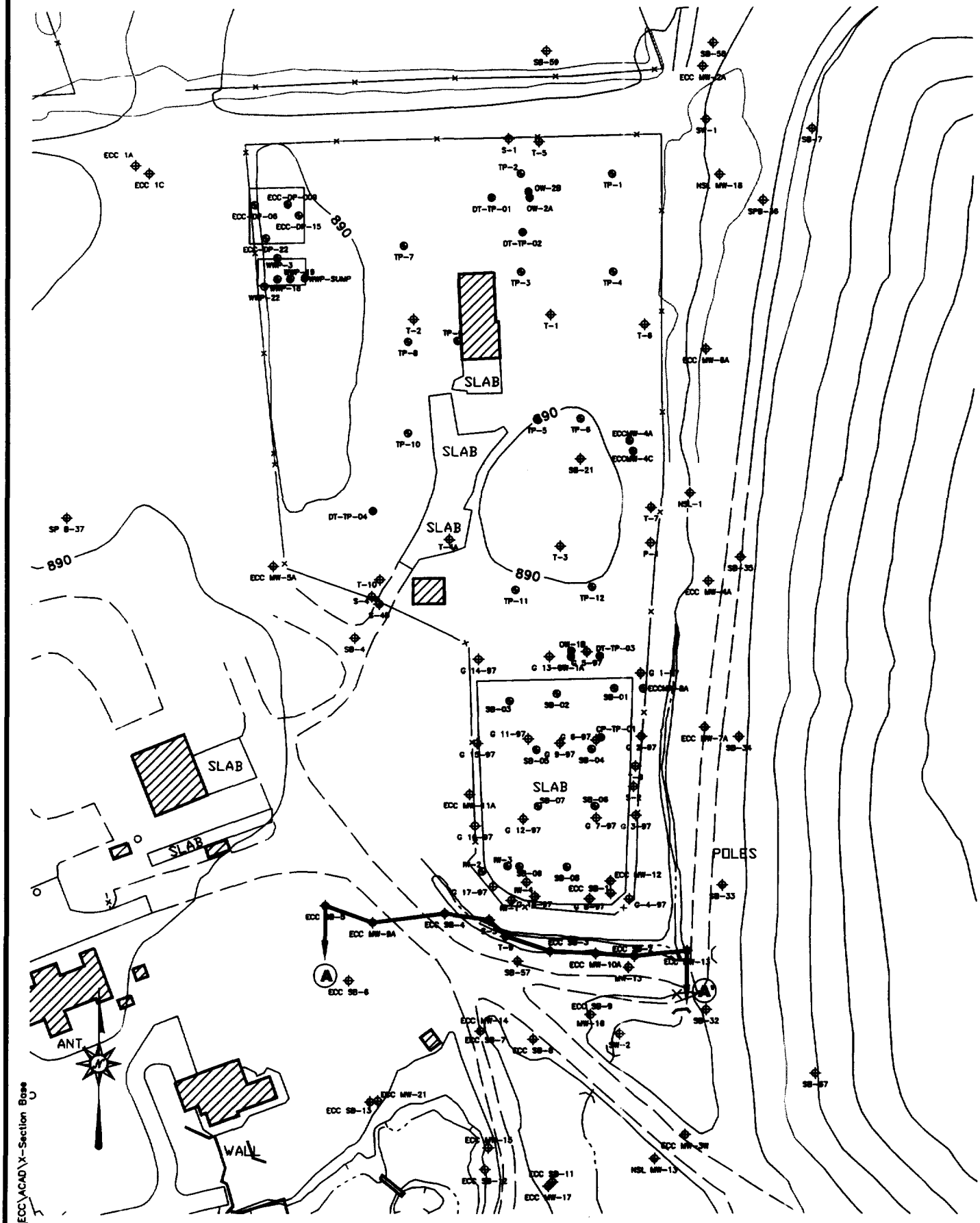
SOURCE: U.S.G.S. 7.5 minute series (topographic)
Rosston Quad, Indiana, Boone County

ENVIRON
650 Dundee Road, Suite 150, Northbrook, IL 60062

Sile Location Map
Enviro-Chem Site
Zionsville, Indiana

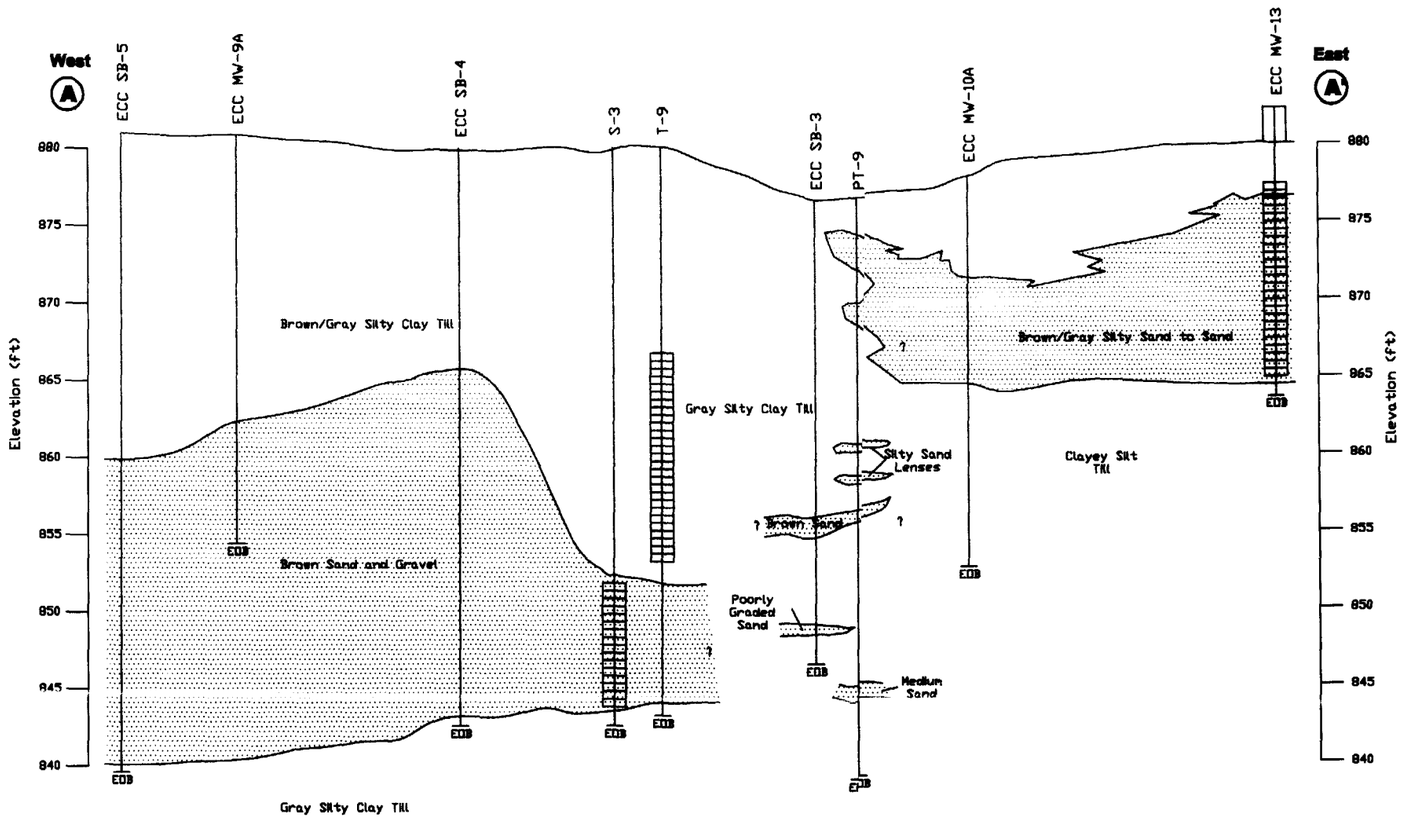
Figure 1

Drafter: GTH Date: 9/29/99 Contract Number: 21-6585A Approved: Revised:



ENVIRON 650 Dundee Road, Suite 150, Northbrook, IL 60062	**Cross Section Base Map** Enviro-Chem Site Zionsville, IN	Figure 2

Drafter: BJM	Date: 8-4-99	Contract Number: 6585C	Approved:	Revised:



Legend

- Monitoring Well Location Showing Screen Location
- Soil Boring Location
- EOB End of Boring
- Till
- Sand

VERTICAL SCALE (ft.) 10' 0

HORIZONTAL SCALE (ft.) 0 40'

ENVIRON

650 DUNDEE ROAD, SUITE 150, NORTHBROOK, IL 60062

Cross Section A–A'
Enviro–Chem Site
Zionsville, IN

DATE:	CONTRACT NUMBER:		FIGURE
8–4–99	6585C		3
DRAFTER: BJM	APPROVED:	REVISED:	

Client Project Files\EGC\Vcad\A-A'

APPENDIX A

Versar's Hot Spot Work Plan

Versar INC.

6 March 1998

Michael McAteer
Remedial Project Manager
U.S EPA Region 5, HSRW-6J
77 West Jackson Blvd
Chicago, Illinois 60604-3590
(312) 886-4663

Vince L. Epps
Project Manager
IDEM
100 North Senate Avenue
P.O. Box 6015
Indianapolis, Indiana 46204
(317) 308-3368

Sent Via Fax

Re: **Enviro-Chem RRA, Zionsville, IN**
Hot Spot Work Plan

Dear Sirs:

Enclosed is a copy of Versar's Draft Hot Spot Work Plan that has been previously orally presented to you. On March 4th USEPA and IDEM authorized Versar to proceed with Tasks 1 through 4 of the attached, (i.e., through the pilot study program).

Versar has arranged for a driller to start in the field on 9 March '98. Therefore, should you have any comments with respect to the work plan, please free to contact Dave Basko at (215) 788-7844, extension 223, before our conference call at 4:30 PM EST on Friday, 6 March '98, so that Versar can proceed as planned.

Very truly yours,

G.J. Anastos, Ph.D., P.E.
Project Manager

enclosure

cc: R Ball, Trustee
N Bernstein, Trustee
J Borucki, Versar
V Britton, Versar
M Dowiak, Radian
A Erickson, Radian
C Gaffney, Versar
T Harrison, CH2M Hill
L Holish, Versar
R Hutchinson, ENVIRON
J Kyle, Trustee
G Scarpone, Handex

Versar proposes the following scope-or-work to address the hot spot identified during the geotechnical evaluation of the Southern Concrete Pad.

Task 1 - Mobilization/Preparation

Appropriate modifications to the existing site specific Health and Safety Plan will be made on or before commencement of the work to be conducted as required by the OSHA. Equipment associated with the withdrawal and storage of concentrated organics from the newly installed extraction wells will be mobilized to the site and tested to assure appropriate operation. This will include all pumps, hoses, mixers, electrical generation, or other necessary equipment. Precaution will be taken to assure that workers will not be exposed to unhealthy chemicals through contact or inhalation.

Task 2 - Soil Exploration Boring

An initial soil exploration boring will be double cased in the zone of contamination and advanced at the location shown on Figure 1 (north of the contaminated area). The location of this boring should not intercept the deep "hot spot" of concentrated organics which was encountered in borings G-17 and G-18. The purpose of this boring is to characterize the underlying stratigraphy proximate to the "hot spot", specifically the depth of the top and bottom of the deep sand unit. Upon completion of the boring, the bore hole will be filled with a bentonite cement slurry.

Task 3 - Extraction/Injection Well Installations

Four double cased (in the zone of contamination) extraction/injection wells (four-inch diameter) will be installed in the southwest corner of the Southern Concrete Pad Area at locations shown on Figure 1. Hollow stem auger drilling methodologies will be utilized coupled with continuous split spoon sampling in each of the wells. All split-spoon samples will be logged geologically and field screened for volatile organic vapors (PID) by a qualified geologist. It is anticipated that the wells will be drilled to a final depth determined in the field by a supervising geologist, depending upon the results of Task 2. It is our intent to intercept the contaminated zone (based on PID measurements and visual observations) with the well screen interval to allow appropriate withdrawal of the concentrated organics and subsequent injection of the Fenton reagent for treatment purposes.

Four-inch diameter PVC casing and well screen (0.010 to 0.020 slot size) will be installed in the boreholes with a bottom cap. A sand pack will be added to approximately one foot above the screened interval. A two foot bentonite seal will be placed on top of the sand pack and the remaining annular space will be grouted with a cement and bentonite slurry. The wells will be completed with a concrete base, protective casing (no more than two feet of stick-up), and locking caps. Drill cuttings will be drummed in 55-gallon drums for subsequent inclusion in the SVE treatment area.

The four newly installed monitoring wells will be developed by purging three to five well volumes from each well. During this development procedure, water level measurements will be taken on 30 to 60 second intervals in the well being developed and proximate wells to qualitatively evaluate hydrogeologic conditions. Development water will be discharged into the existing on-site Frac tanks.

During the boring program, attention will be given to the moisture content in each of the samples, the specific soil classification of the sample, the static water level in the borehole, any changes in water level, and evidence of contamination. All logging will be conducted by a qualified geologist.

Task 4 -Pilot Study

To evaluate specific site efficiency relative to the oxidative process, we will collect two groundwater samples from two of the four newly installed wells (the two wells with the highest concentration of contaminants based on PID measurements). This will allow us to pilot the oxidative process and determine the optimum Fenton reagent dosage for treatment based on the contaminants detected. The results of this evaluation will be summarized in a report prior to proceeding with further field activities associated with the hot spot (Tasks 5 & 6). In addition, two ground water samples will be submitted for CLP full spectrum analysis (VOC's, BN/A's, Pest/PCB's, Metals).

Task 5 - Evacuation of Concentrated Organics

Based on the evaluation of the four monitoring wells discussed in Task 3, one or more of the newly installed extraction/injection wells will be utilized for extraction of the concentrated organics. It is our intent to extract the majority of the concentrated organics (and possibly some free product-DNAPL) from the "hot spot" area prior to in-situ treatment. The concentrated organics removed from the well(s) will be pumped into one or more of the three existing on-site Frac tanks (each tank has a capacity of 21,000 gallons). The concentrated organics will be treated with Fenton reagent to reduce the organic material. The treated material will be tested for compatability with the wastewater treatment system, and when compatablity is assured discharged to the on-site wastewater treatment system.

Task 6 - In-Situ Treatment

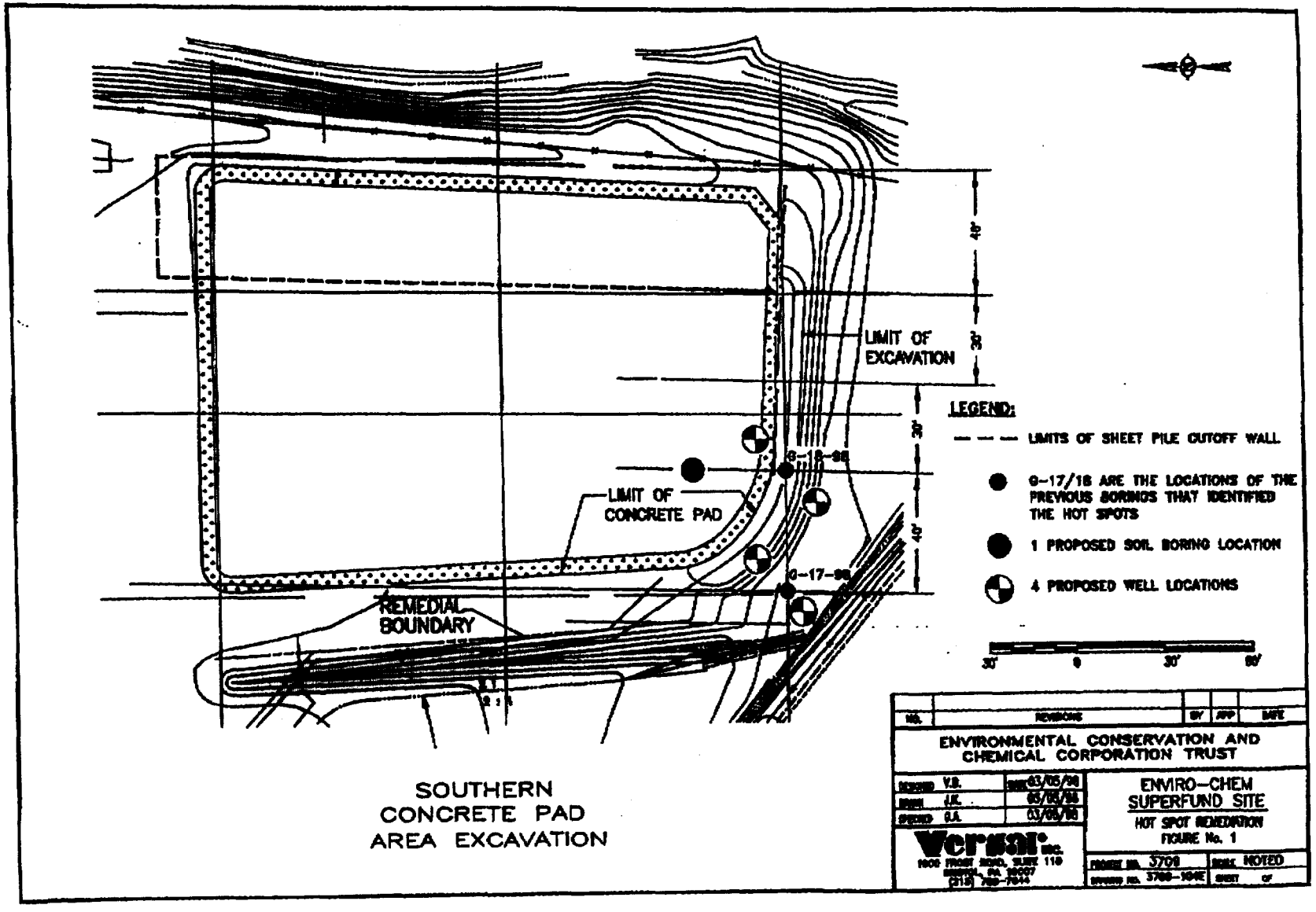
Fenton reagent will be introduced into each of the newly installed wells at concentrations that will be determined in the Task 4 pilot study. This program will consist of introducing the Fenton reagent into the subsurface over a short period of time. During the entire injection process, groundwater levels at the site will be closely monitored to evaluate groundwater mounding and the distribution of the Fenton reagent.

Notes:

1- Trip and field blanks as well as duplicate samples will be taken at the rate specified in Versar's QAP for the Enviro-Chem project.

2- Anticipated Schedule Milestones:

9 March Start Installation of Boring and Wells (tasks 2 & 3)
19 March CLP Data Available
20 March Pilot Study Complete
27 March Report on Tasks 1-4
3 April Start Evacuation of Contaminated Water and In-Situ Treatment (tasks 5 & 6)

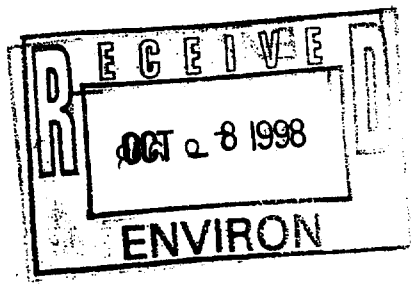


SOUTHERN
CONCRETE PAD
AREA EXCAVATION

APPENDIX B

Versar's Revised Hot Spot #2 Work Plan

Versar INC.



7 October '98

Vince L. Epps
IDEM
100 North Senate Avenue
P.O. Box 6015
Indianapolis, IN 46206-6015

Michael McAteer
USEPA, HSRW-6J
77 West Jackson Blvd.
Chicago, IL 60604-3590

Re: Enviro-Chem RRA
Revised Hot Spot #2 Work Plan

Dear Sirs:

Attached is a copy of the revised Hot Spot # 2 Work Plan for your approval. Versar has incorporated comments from USEPA's letter dated 1 October '98. Versar would like to start work before the end of the month, so your attention to this matter would be appreciated.

Should you have any questions please feel free to contact me at (215) 788-7844, extension 222.

Very truly yours,

G J Anastos

G.J. Anastos, Ph.D., P.E.
Project Manager

attachment

cc: D Basko (Versar)
R Ball (ENVIRON)
J Borucki (Versar)
N Bernstein (NEB & A)
M Dowiak (Radian)
C Gaffney (Versar)
T Harrison (CH2MHill)
R Hutchens (ENVIRON)

1900 FROST ROAD • SUITE 110 • BRISTOL, PENNSYLVANIA 19007 • TELEPHONE (215) 788-7844 • FAX (215) 788-8680

Versar has developed a work plan to address a second hot spot area discovered at the Enviro-Chem site. As you know, during the excavation of the Southern Concrete Pad (SCP) area, dark residual materials were encountered in the southeastern corner of the former SCP area at a depth of approximately 11 feet. This residual material continued outside the Remedial Boundary in the southeast corner of the site. This residual material was excavated to the south approximately 10 feet, and to the west approximately 20 feet. Visible residual material was still evident in the south sidewall when excavation activities were halted. Excavation was halted because of safety concerns and the proximity of the Frac tanks. At the completion of excavation, the area was sampled, backfilled with suitable fill and compacted. Versar has subsequently removed the shoring installed in this area.

Implementation of this work plan will address the visual contamination discussed above and add further information on the geohydrologic characteristics of the second hot spot area. It is Versar's opinion that the second hot spot area should be handled in a similar manner used to treat the first hot spot area and proposes the following activities:

- **Task 1 - Well Inventory:** Versar will prepare a well inventory of all wells within 200 feet of a new proposed recovery well to be located in the second hot spot area. The inventory will include the depth of the wells, screened intervals, diameters, screen slot sizes, static water levels, elevation to top of casings, and any other pertinent information (e.g., PID readings or visual observations). The location of the identified wells will be plotted on a site plan for this area.

- **Task 2 - Well Installation:** Versar will install one recovery well in the hot spot area (proximate to the location of existing geotechnical boring G-4). Hollow stem auger drilling techniques, coupled with continuous split-spoon soil sampling, will be used to advance a bore hole necessary for well placement. All split-spoon samples will be logged geologically and field screened for volatile organic vapors (VOCs) by a qualified geologist. VOC screening will be conducted with the use of a photo-ionization detector (PID) calibrated to an isobutylene standard. Drill cuttings accumulated during the advancement of the auger will be collected for possible distribution on the SVE system on the north or central portion of the property. If the SVE system has been capped, and it is not possible to distribute drill cuttings on the SVE system, they will be properly disposed off-site. It is anticipated that the recovery well will extend to a depth of no greater than 20 feet below ground surface, however, final drilling depths will be determined in the field based on observations. The maximum depth of the well has been determined by a Versar senior geohydrologist based upon his review of borings G-4 and G-8, such that the proposed recovery well does not penetrate the underlying aquifer and create a possible path of cross-contamination to the deeper water-bearing zone and to avoid blow out of the recovery well as a result of the Artesian conditions of the underlying aquifer. Criteria to be utilized in the field to determine the final depth of the recovery well are the presence of sands, water and residual

contamination (visual and PID readings). It is our intent to intercept the contaminated zone (determined based on PID screening and visual observation) with the well screen interval to allow appropriate withdrawal of water and subsequent injection of Fenton reagent for remedial purposes. Criteria to be utilized in the field to determine the screening interval of the recovery well are; the presence of saturated sands, visual presence of residual material and PID readings above 10 ppm.

The recovery well will be constructed of four inch diameter, schedule 40 PVC casing and well screen with a slot size of 0.010 to 0.020 inches. The annular space of the well will be filled with coarse grade silica sand up to approximately one foot above the screened interval. A three foot layer of bentonite clay will be placed on top of the sand pack to serve as an annular seal and prohibit the vertical migration of fluids into the well screen area. The remaining annular space will be grouted with a bentonite cement slurry up to the ground surface. The top of the PVC casing will extend above the ground surface and will be fitted with an expandable water tight well cap. The well will be completed with a protective steel riser casing (no higher than two feet) set in concrete and secured with a locking lid.

The newly installed recovery well will be developed by purging three to five well volumes. Well development water will be deposited in a temporary 500 gallon plastic wastewater holding tank for on-site treatment. Water level measurements in the subject well and in proximate wells will be taken at the start of and on 30 to 60 second intervals during the well development process to qualitatively evaluate hydraulic conditions. During this process, an approximate water yield rate (pumping rate) will be determined. This will enable Versar to determine the appropriate sized pump to be used in the water evacuation process discussed in Task 3 (below).

- **Task 3 - Evacuation of Residual and Subsurface Water:** The recovery well will be pumped (low rate) continuously, if a sustained yield is feasible, for approximately one week to allow for the removal of residual and subsurface water in the second hot spot area. It is anticipated that a pumping rate of less than one gallon per minute will allow the continuous flow of water into the pump while at the same time appropriately evacuating water from the formation. All residual and water evacuated from the recovery well will be stored on-site, treated with Fenton reagent, and discharged to the on-site waste water treatment system.

During the evacuation process, water level measurements in proximate wells will be closely monitored. Water level measurements will be collected hourly for the first six hours of pumping and twice daily (morning and afternoon) for the next three days. A detailed log of times and depth to groundwater for each well will be recorded. A multi-channel data logger fitted with pressure transducers will be utilized for this task. Manual measurements will be taken as a back-up.

- **Task 4 - Evaluation of Data and Treatment of Residuals in Soil:** Water level data will be evaluated to determine the hydrogeologic characteristics of the underlying strata. Both hot spot areas will be treated in-situ with Fenton reagent. If a potential hydraulic connection between the hot spots is detected, Hot Spot # 2 will be treated prior to the retreatment of Hot Spot # 1.

  To evaluate the effectiveness of the Fenton reagent treatment, an active subsurface water monitoring program will be conducted on-site. The program will include bi-weekly sampling (for a period of two months) of the recovery well (second hot spot area) and the two original wells (first hot spot area) for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total organic carbon (TOC), dissolved oxygen (DO), redox potential, hydroxyl radical, pH, temperature, and conductivity.

  Should the monitoring indicate that residual organics remain, a second application of Fenton reagent will be considered based upon an analysis of the data. Treatment effectiveness will be measured with respect to water samples taken from the recovery well that are assumed to be in equilibrium with soil compared to the Revised Exhibit A Table 3-1 Soil Clean-up Standards.

Attachment 1
Response to 1 Oct. '98 USEPA Comments on the Preliminary Issued Hot Spot #2 Work Plan

Comment #1 Page 1, Paragraph 1:

Versar has clarified the wording to reflect USEPA comment on the presence of visual residual contamination on the bottom of the south sidewall.

Comment #2 Page 1, Paragraph 2:

Implementation of this work plan will address the visual contamination discussed above and add further information on the geohydrologic characteristics of the second hot spot area. Borings G-4 and G-8 have been utilized in the development of this treatment of the second hot spot area. The water level monitoring during development and pumping will add further data as to the geohydrologic conditions along the southern side of the former SCP.

Comment #3 Page 1, Task 2:

It is anticipated that the recovery well will extend to a depth no greater than 20 feet below ground surface (in order to avoid blowing out the recovery well as a result of the Artesian condition of the underlying aquifer); however, final drilling depths will be determined in the field based on observations. The maximum depth of the well has been determined by a Versar senior geohydrologist based upon his review of boring G-4 and G-8. It is our intention to intercept all possible contamination zone(s), based on PID screening and visual observation with the well screen interval to allow appropriate withdrawal of water and subsequent injection of Fenton Reagent for remedial purposes. Criteria to be utilized in the field to determine the screening interval of the recovery well are; the presence of saturated sands, visual presence of residual material and PID readings above 10 ppm.

Comment #4 Page 1, Task 4:

Versar has clarified the work plan to reflect USEPA's comment. If a potential hydraulic connection between the hot spots is detected, Hot Spot # 2 will be treated prior to the retreatment of Hot Spot # 1.

To evaluate the effectiveness of the Fenton reagent treatment, bi-weekly samples will be taken (for a period of up to two months) from the recovery well (second hot spot) and the two original wells (first hot spot area) and will be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total organic carbon (TOC), dissolved oxygen (DO), redox potential, hydroxyl radical, pH, temperature, and conductivity.

Should the monitoring indicate residual organics remain, a second application of Fenton Reagent will be considered based upon an analysis of the data. Treatment effectiveness will be measured with respect to water samples taken from the recovery well that are assumed to be in equilibrium with soil compared to the Revised Exhibit A, Table 3-1 Soil Clean-Up Standards.

APPENDIX C

Boring and Well Construction Logs

DRILL LOG

PROJECT ENVIRO-CHEM	OWNER ----------		SKETCH MAP
LOCATION ZIONSVILLE, IN	W.O. NUMBER 2495-1010		ND - NOT DETECTED
BORING NUMBER IW -4	TOTAL DEPTH 28.00'	DIAMETER 8"	VPPM - VAPOR PARTS PER MILLION
SURFACE ELEV. ---	WAT LEV: INIT - -	24-HRS -----	SS - SPLIT SPOON
SCREEN: DIA 4"	LENGTH 10'	SLOT SIZE .020	F - FINE M - MEDIUM
CASING: DIA 4"	LENGTH 17'	TYPE PVC	C - COARSE
DRILLING COMPANY TOP FLIGHT	DRITILLING METHOD HSA		
DRILLER NICK	LOG BY VFB	DATE DRILLED 3/16/98	NOTES

Depth (feet)	Graphic Log	Well Construction	Sample Number	Blow Count/ RQD/ % REC.	PID READINGS (VPPM)	DESCRIPTION / SOIL CLASSIFICATION((COLOR, TEXTURE, STRUCTURES, MOISTURE, OVA READINGS)
1						0 - 7.0 GREY BROWN CLAY, LITTLE
2						TO TRACE SILT, TRACE FINE
3					110	TO COARSE SAND, WET,
4						DISTURBED, ODOR PRESENT
5						
6			SS-43	8-11	6	7.0 - 10.0 GREY CLAY, SOME SILT,
7				12-12		TRACE FINE SAND, TRACE
8			SS-44	10-11		M-C GRAVEL, DAMP, NO ODOR
9				14-16		
10			SS-45	6-7	41	10.0 - 10.2 BROWN M-C SAND, SATURATED.,
11				8-14		NO ODOR
12			SS-46	11-12	11	10.2 - 11.8 GREY CLAY, SOME SILT,
13				12-15		TRACE F-C SAND, DAMP, NO ODOR
14			SS-47	6-8	34	11.8 - 12.4 BROWN MEDIUM SAND, SATURATED,
15				12-14		NO ODOR
16			SS-48	5-4	15	12.4 - 13.8 GREY CLAY, SOME SILT, TRACE FINE
17				12-12		SAND, DAMP, NO ODOR
18			SS-49	10-11	15.7,	13.8-14.4 BROWN MEDIUM SAND, SATURATED,
19				12-18		SLIGHT ODOR
20			SS-50	9-10	3.5	14.4 - 15.2 GREY AND BROWN CLAY AND
21				10-11		SILT, TRACE F-C SAND/GRAVEL, DAMP
22			SS-51	3-4	13	15.2-15.6 BROWN MEDIUM SAND, SATURATED,
23				7-12		NO ODOR

DRILL LOG - IW 4 (continued)

PROJECT ENVIRO-CHEM	OWNER ----------		SKETCH MAP
LOCATION ZIONSVILLE, IN	W.O. NUMBER 2495-1010		ND - NOT DETECTED
BORING NUMBER IW -4	TOTAL DEPTH 28.00"	DIAMETER 8"	VPPM - VAPOR PARTS PER MILLION
SURFACE ELEV. ---	WAT LEV: INIT - -	24-HRS ----	SS - SPLIT SPOON
SCREEN: DIA 4"	LENGTH 10'	SLOT SIZE .020	F - FINE M - MEDIUM
CASING: DIA 4"	LENGTH 17'	TYPE PVC	C - COARSE
DRILLING COMPANY TOP FLIGHT	DRITILLING METHOD HSA		
DRILLER NICK	LOG BY VFB	DATE DRILLED 3/16/98	NOTES

Depth (feet)	Graphic Log	Well Construction	Sample Number	Blow Count/ RQD/ % REC.	PID READINGS (VPPM)	DESCRIPTION / SOIL CLASSIFICATION((COLOR, TEXTURE, STRUCTURES, MOISTURE, OVA READINGS)
24			SS-52	3-6	3	15.6 - 17.8 GREY CLAY AND SILT,
25				10-10		TRACE F-C SAND/GRAVEL, DAMP,
26			SS-53	6-13	1	NO ODOR
27				15-21		17.8 - 21.0 BROWN POORLY SORTED
28						SAND, SATURATED, ODOR
						PRESENT
						21.0 - 25.0 GREY CLAY, LITTLE SILT,
						DAMP, SLIGHT ODOR
						25.0 - 25.3 BROWN SAND, SATURATED,
						NO ODOR
						25.3 - 27.0 GREY CLAY, LITTLE SILT,
						NO ODOR, DAMP
						27.0 - 27.3 BROWN SAND, SATURATED,
						NO ODOR
						27.3 - 28.0 GREY CLAY, LITTLE SILT,
						DAMP, NO ODOR

DRAFT

PROJECT NUMBER	BORING NUMBER
W64641.FQ	ECC SB-03 SHEET 1 OF 1

SOIL BORING LOG

PROJECT NSL/ECC LOCATION Zionsville, Indiana

ELEVATION DRILLING CONTRACTOR ATEC Associates

DRILLING METHOD AND EQUIPMENT HSA(3 3/8" i.d.) /Mobile Drill B61

WATER LEVEL AND DATE START 4/5/88 FINISH 4/5/88 LOGGER C. Cruciani

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	SYMBOLIC LOG	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
		S01	0.9	3-6-6-6 (12)	6" Silty Clay, dk br, tr. grav, wet, soft 2" Gravel, black 4" Clayey Silt, dk br to black, moist, soft to firm		Start 0850 HNu=1.0ppm ABG Bg=0.5ppm Fill
		S02	1.0	5-4-4-5 (8)	Silty Clay, tr sand, gravel dk br to black, moist Soft, organic staining One dolomite cobble =2" diam (CL-ML)		t=0906 HNu=0.5ppm ABG Drillers only have 1 split spoon!
5		S03	1.5	2-6-7-9 (13)	Silty Clay, tr sand, gravel, lt orangish brown/gray, moist, soft, some "roots", mottled. (CL-ML)		t=0912 HNu=0.2ppm-0 ABG Took duplicate of physical sample
		S04	1.8	6-7-8-9 (15)	As above, soft to firm, black "staining" (CL-ML)		t=0918 HNu=0 ABG
		S05	1.6	5-6-7-9 (13)	Top 1' as above (No mottling)(CL-ML) Bottom 0.6 Silty Clay, gray, dry to moist, firm gravel, fine sand		t=0928 HNu=Bg
10		S06	1.5	5-6-7-8 (13)	As above Soft to Firm (CL-ML)		t=0934 HNu=0.2ppm ABG Took chemical set
		S07	1.5	3-4-6-7 (10)	As above (CL-ML)		t=0941 HNu=Bg
		S08	1.6	3-4-5-6 (9)	As above (CL-ML)		t=0948 HNu=Bg
15		S09	1.3	3-5-6-8 (11)	As above, soft (CL-ML)		gradation? More sand t=0956 HNu=0.5ppm ABG
		S10	1.5	3-5-6-8 (11)	Top 1.1' As above, more fine sand, soft, (CL-ML) Lower 0.4' silty clay, tr. fine sand, grey, dry, hard		t=1022 HNu= B.G. t=1022
20		S11	1.7	10-12-18-19 (30)	Top 1' As above, more (CL-ML) 0.3' fine, poorly graded sand, tr silt, gray, wet (SP) 0.4' F.C. poorly graded sand (SP) little to no silt, wet, med dense		HNu=0.4 in sand
		S12	1.9	11-14-18-25 (32)	Top 2" As above (SP) Lower 1.6' silty clay/clayey silt, grey, dry to moist, hard, tr fine sand, tr grav (CL-ML)		t=1035 HNu=0.2 in sand seam Not enough for chemical sample
25		S13	1.7	13-18-27-40 (45)	As above Hard to stiff (CL-ML) 1.5' As above		t=1059 HNu=B.G. Took VOA's only Very hard to sample
		S14	1.9	30-48-94-90	Lower 5" fine, poorly graded sand, tr. silt, dk. brown to gray, moist, dense		t=1100 HNu=2.0ppm ABG on fine sar Rock at =27'
		S15	1.2	28-100-50/0.2	Silty clay/clayey silt, dk brown, dry hard, crumbles (CL-ML) End soil Boring @ 30'		t=1122 HNu=B.G.

DRAFT

PROJECT NUMBER	BORING NUMBER
W64641.PQ	ECC SB-04 SHEET 1 OF 2

SOIL BORING LOG

PROJECT NSL/ECC LOCATION Zionsville, Indiana

ELEVATION DRILLING CONTRACTOR ATEC Associates

DRILLING METHOD AND EQUIPMENT HSA(3 3/8" i.d.) /Mobile Drill B61

WATER LEVEL AND DATE START 4/14/88 FINISH 4/14/88 LOGGER Bob Brownfield

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					2" crushed stone		Spoon
		S1	1.3	5-12-7-8 (19)	14" silt dark gray to black, dry to moist, firm, ~5% coarse sand. (ML)		t=1530 HNu ppm Bkg
		S2	1.8	2-5-6-7 (11)	Same as above.		(weathered fill)
5		S3	2.0	2-2-3-5 (5)	Same as above, brown, moist to wet		t=1550
		S4	1.7	5-4-6-17 (10)	Same as above, gray, wet on outside moist on inside.		
		S5	2.0	5-6-7-8 (13)	Same as above, moist		t=1605
10		S6	1.7	4-5-6-8 (11)	Same as above		
		S7	1.7	2-2-3-4 (5)	Silt gray, moist, <5% coarse sand, low plasticity, soft. (ML)		
		S8	1.7	4-5-6-7 (11)	gravel gray, 3/4" max., ~30% sand, well graded, clean wet. (GW)		t=1620
15		S9	2.0	5-7-6-6 (13)	Sand gray, coarse, wet, <2% silt (SP)		
		S10	1.5	7-7-9-9 (16)	Same as above, but well graded. (SW)		
20		S11	1.3	8-9-10-11 (19)	Same as above		
		S12	1.0	7-8-9-10 (17)	Same as above. ~10% gravel 3/4" max.		
		S13	1.5	8-10-12-12 (22)	Same as S12		
25		S14	1.7	8-12-13-18 (25)	Sand, gray med. to coarse, <5% silt, ~10% gravel, wet.		Took Chemical Samples - No Physical
		S15	1.5	12-14-19-21 (33)	Sand gray, fine to med, <5% silt. (SW)		

DRAFT

PROJECT NUMBER	BORING NUMBER
W64641.FQ	ECC SB-04 SHEET 2 OF 2

SOIL BORING LOG

PROJECT NSL/ECC LOCATION Zionsville, Indiana

ELEVATION DRILLING CONTRACTOR ATEC Associates

DRILLING METHOD AND EQUIPMENT HSA(3 3/8" i.d.) /Mobile Drill B61

WATER LEVEL AND DATE START 4/14/88 FINISH 4/14/88 LOGGER Bob Brownfield

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
30		S16	2.0	10-14-24-20 (38)	Sand fine, clean dense, gray wet w/ 1" high plasticity clay seams every 8 to 10"		HNu Bkg
		S17	2.0	9-12-15-15 (27)	Sand gray, v. fine, ~5% silt in sand, 1" silt seams every 3-4".		
35		S18	2.0	10-36-17-31 (53)	Sand as above 8" Silt gray, v. hard, dry, ~10% coarse sand, low plast (ML) End Soil Boring @ 36'		

DRAFT

PROJECT NUMBER	BORING NUMBER
W64641.FQ	ECC SB-05 SHEET 1 OF 2

SOIL BORING LOG

PROJECT NSL/ECC LOCATION Zionsville, Indiana

ELEVATION DRILLING CONTRACTOR ATEC Associates

DRILLING METHOD AND EQUIPMENT HSA(3 3/8" i.d.) /Mobile Drill B61

WATER LEVEL AND DATE START 4/13/88 FINISH 4/13/88 LOGGER C Cruciani

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	SYMBOLIC LOG	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
		S1	1.6	2-2-3-4 (5)	Silty clay, brown, moist, soft, tr sand (CL)		Start @ 1500 (Topsoil) t=1506 HNu= B.G.
		S2	1.4	2-2-3-3 (5)	As above (CL) one crack 8" from bottom, tr. gravel		t=1512 HNu=B.G.
		S3	∅	2-3-3-4 (6)	No recovery 1st attempt No recovery 2nd attempt NO SAMPLE		t=1514 HNu=B.G. Told drillers to drill to 6' try for 6-8'
5		S4	2.0	3-5-8-10 (13)	As above grades to firm (CL)		t=1522 HNu=B.G.
		S5	2.0	4-6-7-10 (13)	Silty clay, gray, moist, firm, tr sand, tr gravel (CL)		t=1529 HNu=B.G. Took Physical Duplicate
10		S6	2.0	2-6-7-8 (13)	As above		t=1530 HNu=B.G., No physical sample Took Chemical Sample
		S7	1.6	1-3-4-6 (7)	As above 1.3' Lower 6" 3-4 "cracks" filled with sand Lower 1" well graded M-C sand, grey, wet 150 se, tr. gravel (SW)		t=1538 HNu=B.G.
15		S8	2.0	2-4-6-7 (10)	Silty clay, tr gravel, grey, soft 1/8" sand seam 1" from top (CL)		t=1542 HNu=B.G.
		S9	1.5	2-4-7-14 (11)	As above (CL) 1' sand seam 0.4' from top, 1' from top. Bottom 1" F-M sand, grey, wet, loose		t=1548 HNu=B.G.
		S10	1.0	2-4-6-10 (10)	0.3 interlayered sand & gravel, grey, differing lithologies, wet, loose (GW-SW) 0.3' as S8 0.4' sand & gravel (SW)		t=1555 HNu=B.G.
20		S11	2.0	8-9-10-11 (19)	1.0' sand & gravel as above 1.0' sand, med, gray, wet <5% silt, ~5% small gravel. (SP)		
		S12	1.2	6-8-10-10 (18)	Same as above, med to coarse (SP)		
25		S13	1.6	6-8-9-12 (17)	Same as above (SP)		
		S14	0.7	6-8-10-12 (18)	0.4 Same as above 0.3 sand, gray, fine, clean (SP)		
		S15	1.7	3-7-12-14 (19)	Sand gray, fine wet, clean. (SP)		Chemical set

DRAFT

PROJECT NUMBER	BORING NUMBER		
W64641.FQ	ECC SB-5	SHEET 2	OF 2

SOIL BORING LOG

PROJECT NSL/ECC LOCATION Zionsville, Indiana

ELEVATION DRILLING CONTRACTOR ATEC Associates

DRILLING METHOD AND EQUIPMENT HSA(3 3/8" i.d.) /Mobile Drill B61

WATER LEVEL AND DATE START 4/13/88 FINISH 4/13/88 LOGGER C Cruciani

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		S16	1.3	10-12-14-18 (26)	Same as above		
		S17	1.8	10-19-29-30 (48)	Same as above		
35		S18	1.8	8-20-25-32 (45)	8" as above 14" Sand gray, v. fine, wet, clean. (SP)		t=1750 HNu=Bg
		S19	2.0	8-14-20-19	Same as above. (~2% Silt)		
		S20	2.0	8-14-20-22	Sand v. fine, wet, gray, ~30% silt, 1/2" silt seams every 6 or 8" (SM)		
40		S22	2.0	8-12-30-46	12" as above 6" coarse sandy gravel 6" silt gray, hard, dry, ~10% small gravel		(till))
					End Soil Boring @ 42'		
45							

[ECC mw-15]

PROJECT NUMBER	BORING NUMBER
W64641.FQ	ECC SB-02 SHEET 1 OF 1

SOIL BORING LOG

PROJECT NSL/ECC LOCATION Zionsville, Indiana

ELEVATION DRILLING CONTRACTOR ATEC Associates

DRILLING METHOD AND EQUIPMENT HSA(3 3/8" i.d.) /Mobile Drill B61

WATER LEVEL AND DATE START 4/16/88 FINISH 4/16/88 LOGGER B. Brownfield

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION	Spoon Hnu ppm
		S1	1.7	7-8-10-11 (18)	top 10" silty dry fill, brown. bot. 10" fine sand, dry fill. Brown			0.0
		S2	0." took another 0.8	5-5-6-6 (11)	Silt dark gray, moist, low plasticity, soft. ~10% by volume of what looked like charcoal. (ML) 8" silt as above (ML)			0.0
		S3	1.0	2-2-3-2 (5)	4" Silty sand ~30% silt, <10% clay sand was light brown, med. wet. (SM) 2" Silty sand as above (SM)			0.0
5		S4	1.0	4-10-12-13 (22)	10" Sand coarse, wet, brown, ~10% silt (SW)			0.0
		S5	1.7	4-8-8-8 (16)	Sand same as above, black band at 9' 10% gravel (3/4" max) (SW)		Took small jar chem anal t=1045	0.0
10		S6	1.8	7-8-10-10 18	2" Sand med-coarse, brown 25% silt, wet (SP) 20" Same as S5 (SW)		Took large chem jars t = 1050	0.0
		S7	1.5	6-10-13-18 (23)	Sand as in S5 (SW)			1.0
15		S8	2.0	23-42-55-85 (97)	4" Sand as above (SW) 20" Silt, dry to moist, hard, gray, ~20% rocks up to 1". (ML)	-566	Took Chem. of fill. (till)	
		S9			End of Boring @ 16'		Set screen from 14' to 4'	
		S10			Started setting well @ 11:30 AM		Sandpack 14.5 to 3'	
20		S11					Bentonite 3' to 2' grout to surface.	
		S12						
25		S13						
		S14						
		S15						

ENVIRON

650 Dundee Road, Suite 150
Northbrook, Ilinois 60062

WELL CONSTRUCTION LOG

MONITORING WELL NO.: T-9

TOTAL DEPTH: 25.5'

PROJECT INFORMATION

PROJECT:	**ECC: Monitoring Wells**
SITE LOCATION:	**Zionsville, IN**
JOB NO.:	**21-6585B**
LOGGED BY:	**Scott Hayter**
DATE(S) DRILLED:	**5-11-98**

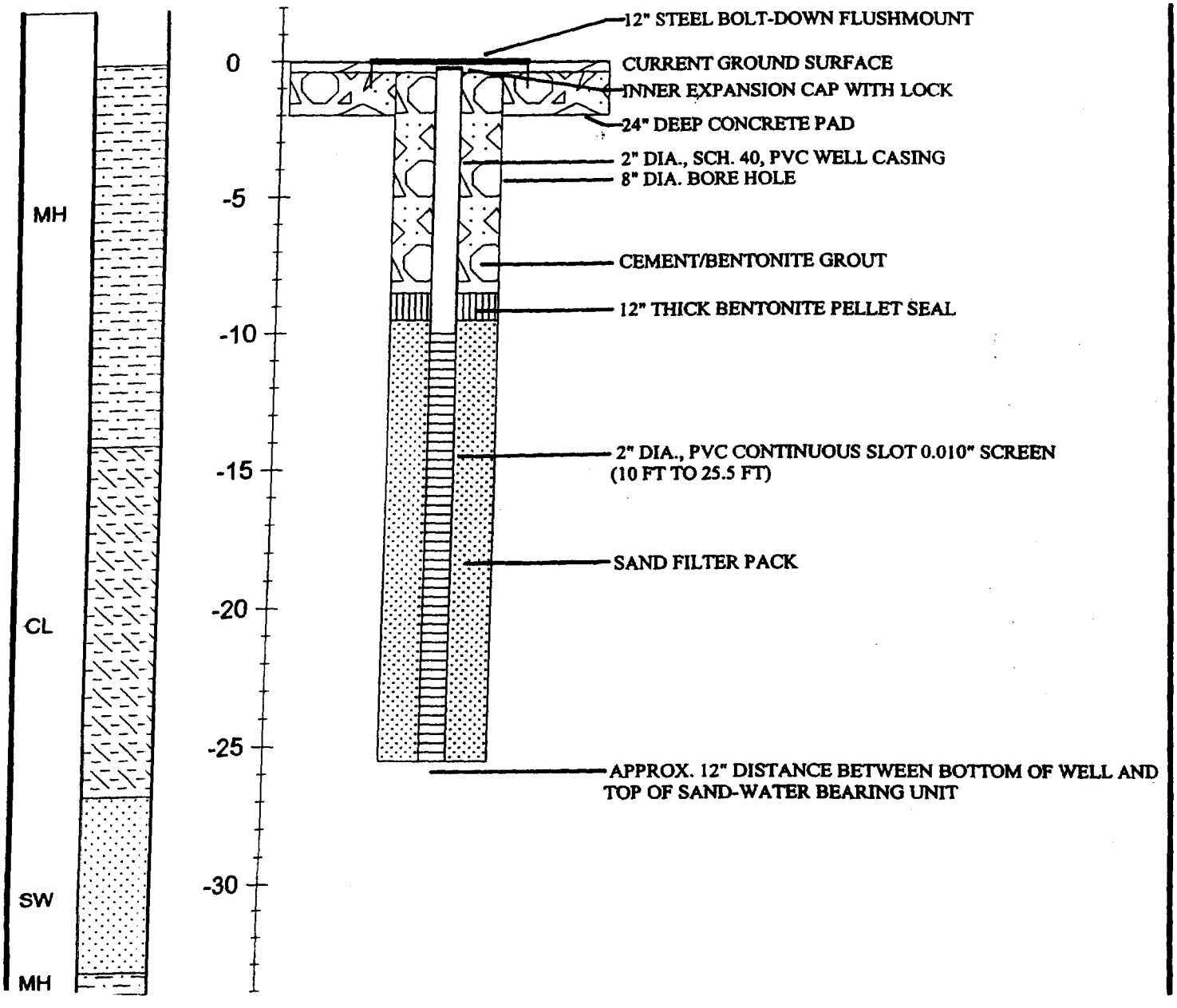
DRILLING INFORMATION

DRILLING CO.:	**EDAC**
DRILLER:	**Dan Dreyer**
RIG TYPE:	**Gus Peck GP-1300**
METHOD OF DRILLING:	**hollow-stem auger**
BORE HOLE DIAMETER:	**California split spoon**

T.O.C. ELEVATION: 882.08

SURVEY COORDINATES: **921571.18N 725827.61E**

USCS | GRAPHIC LOG | DEPTH (ft) | WELL CONSTRUCTION



ENVIRON

650 Dundee Road, Suite 150
Northbrook, Illinois 60062

GEOLOGIC DRILL LOG

BOREHOLE NO.: **T-9**
TOTAL DEPTH: **34.0'**

PROJECT INFORMATION

PROJECT:	**ECC: Monitoring Wells**
SITE LOCATION:	**Zionsville, IN**
JOB NO.:	**21-6585B**
LOGGED BY:	**Scott Hayter**
PROJECT MANAGER:	**Ron Hutchens**
DATES DRILLED:	**5-5-98**

DRILLING INFORMATION

DRILLING CO.:	**EDAC**
DRILLER:	**Dan Dreyer**
RIG TYPE:	**Gus Peck GP-1300**
METHOD OF DRILLING:	**hollow-stem auger**
SAMPLING METHODS:	**split spoon**
HAMMER WT./DROP	**140 lb., 30 in.**

NOTES:

SS INTERVAL (ft)	SS RECOVERY (ft)	BLOW COUNTS	PID (ppm)	DEPTH (ft)	GRAPHIC LOG	USCS	LAYER DEPTH (ft)	SOIL DESCRIPTION
0-10		no sampling		0				SILT; field observation
10-12	0.5	1, 2, 3, 6	<1	-5				
12-14	0	4, 5, 5, 8	<1	-10		MH		SILT: Gray-brown silt with a little clay, a little sand, and a trace of gravel. Dry.
14-16	1.5	3, 4, 6, 8	<1	-15			14.0	SILTY CLAY: Dark gray-brown silty clay with a trace of fine gravel and few sand. Moist.
16-18	1.5	1, 1, 3, 4	<1	-20		CL		
18-20	1.5	1, 1, 3, 4	<1					
20-22	1.1	1, 1, 2, 2	<1					
22-24	1.8	1, 1, 2, 4	<1					
24-26	1.4	1, 1, 3, 4	<1	-25			26.7	SAND: Medium to coarse sand with a trace of fine gravel. Dry.
26-28	2.0	1, 1, 1, 4	<1					
28-30	1.3	1, 1, 1, 4	<1	-30		SW		
30-32	2.0	2, 2, 4, 8	<1					
32-34	2.0	5, 13, 48, 48	<1			MH	33.2	SILT: Dark brown silt with a trace of clay and a trace of fine gravel. Dry.

ENVIRON

650 Dundee Road, Suite 150
Northbrook, Ilinois 60062

WELL CONSTRUCTION LOG

MONITORING WELL NO. **S-3**

TOTAL DEPTH: **35.5'**

PROJECT INFORMATION

PROJECT:	**ECC: Monitoring Wells**
SITE LOCATION:	**Zionsville, IN**
JOB NO.:	**21-6585B**
LOGGED BY:	**Matt Makowski**
DATE(S) DRILLED:	**5-12-98**

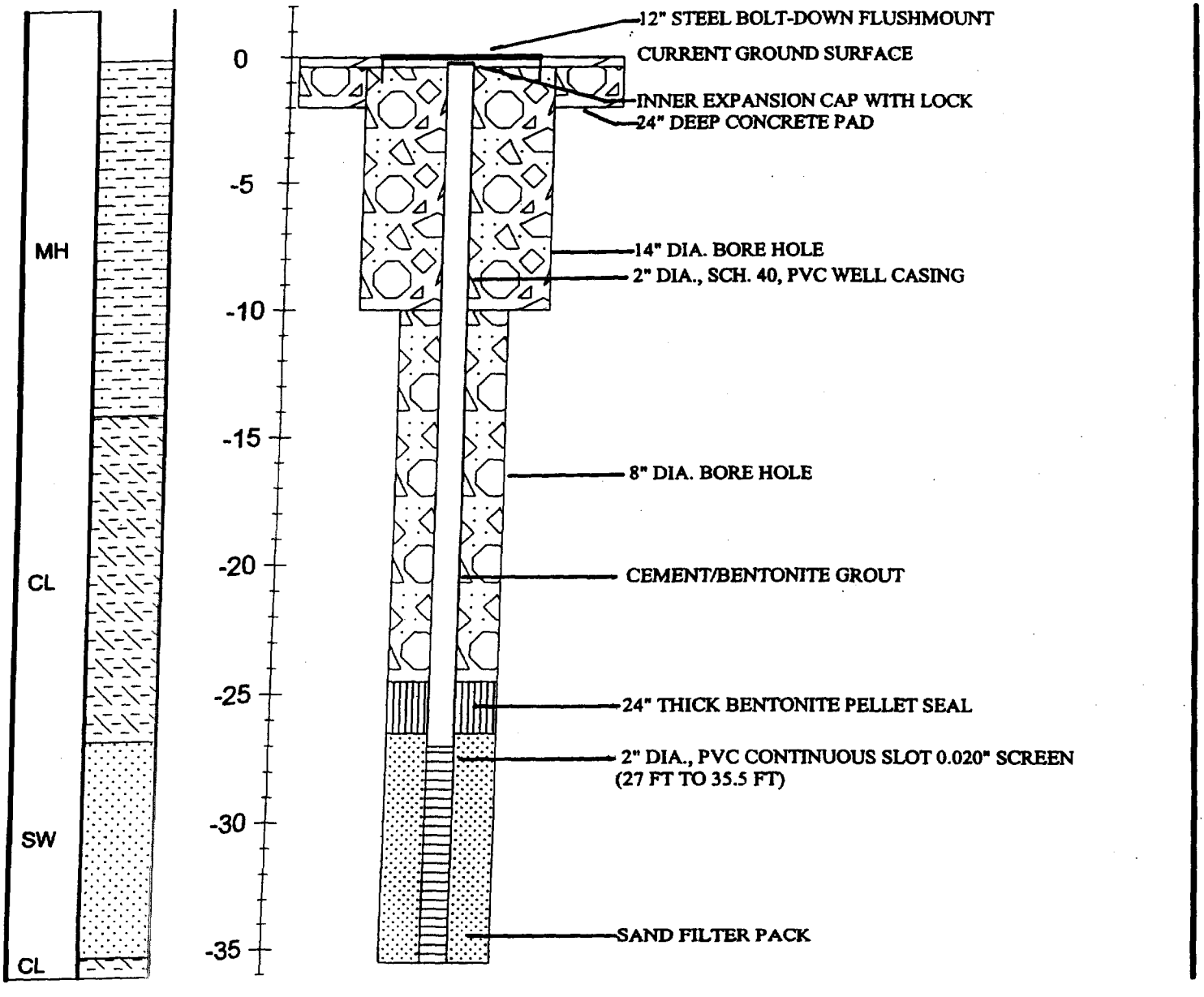
DRILLING INFORMATION

DRILLING CO.:	**EDAC**
DRILLER:	**Dan Dreyer**
RIG TYPE:	**Gus Peck GP-1300**
METHOD OF DRILLING:	**hollow-stem auger**
BORE HOLE DIAMETER:	**California split spoon**

T.O.C. ELEVATION: **882.45**

SURVEY COORDINATES: **921585.65N 725813.30E**

USCS	GRAPHIC LOG	DEPTH (ft)	WELL CONSTRUCTION



ENVIRON

650 Dundee Road, Suite 150
Northbrook, Illinois 60062

GEOLOGIC DRILL LOG

BOREHOLE NO.: **S-3**
TOTAL DEPTH: **36'**

PROJECT INFORMATION

PROJECT:	**ECC: Monitoring Wells**
SITE LOCATION:	**Zionsville, IN**
JOB NO.:	**21-6585B**
LOGGED BY:	**Scott Hayter**
PROJECT MANAGER:	**Ron Hutchens**
DATES DRILLED:	**5-11-98**

DRILLING INFORMATION

DRILLING CO.:	**EDAC**
DRILLER:	**Dan Dreyer**
RIG TYPE:	**Gus Peck GP-1300**
METHOD OF DRILLING:	**hollow-stem auger**
SAMPLING METHODS:	**split spoon**
HAMMER WT./DROP	**140 lb., 30 in.**

NOTES: Log information from 0 to 32' was copied from boring T-9.

SS INTERVAL (ft)	SS RECOVERY (ft)	BLOW COUNTS	PID (ppm)	DEPTH (ft)	GRAPHIC LOG	USCS	LAYER DEPTH (ft)	SOIL DESCRIPTION
0-32		no sampling		-10		MH		No samples 0-10 ft: SILT: (10 to 32 ft soil information from boring T-9)
							14.0	SILTY CLAY: (from boring T-9)
				-15		CL		
				-20				
				-25				
							26.7	SAND: (from boring T-9)
				-30		SW		
32-34	2.0	>100	2			SW		SAND: Medium to coarse sand with a trace of fine gravel. Dry
34-36	2.0	2, 12, 17, 22	1	-35		CL	35.2	SILTY CLAY: Light brown silty clay

CH2M HILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
W65230.C3	ECC-9A	1	1

SOIL BORING LOG

PROJECT ECC - RT LOCATION Southwest of SW Corner of Sit
ELEVATION DRILLING CONTRACTOR ATEC
DRILLING METHOD AND EQUIPMENT Mobil B-61 Rig 4" I.D. HSA's and 6" I.D. HSA's
START 10/31/84 FINISH 11/2/84 LOGGER T. H. Johnson
WATER LEVEL AND DATE

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	2							HNu reading background (~0.5pp
	4							
	6							
	8							
	10		SS-1	18"	6-11-18	Silty Clay, Gray, Stiff, moist some sand and fine gravel.		
	12							
	14		SS-2	0"	7-11-17	Silty Clay, Gray, stiff, moist some sand and fine gravel		
	16							
	18		SS-3	12"	4-4-12	~18' Sand and Gravel, Fine to Coarse, Gray, wet		Sand flowed in to Bottom of HSA's to 6' B.G.S. a driving SS-3. H to ream borah with 6" I.D. H and added w to set well pipe and scr
	20							
	22							
	24					Bottom of Boring @ 25'		
	26							

APPENDIX D

Versar's Hot Spot Pilot Study Results

Versar INC.

13 April 1998

Michael McAteer
Remedial Project Manager
U.S EPA Region 5, HSRW-6J
77 West Jackson Blvd
Chicago, Illinois 60604-3590
(312) 886-4663

Vince L. Epps
Project Manager
IDEM
100 North Senate Avenue
P.O. Box 6015
Indianapolis, Indiana 46204
(317) 308-3368

Sent Via Fax

Re: **Enviro-Chem RRA, Zionsville, IN**
Hot Spot Pilot Study Results

Dear Sirs:

Enclosed is a copy of Versar's Hot Spot Pilot Study Results. A conference call to obtain final approval to implement the Fenton reagent treatment is scheduled for Wednesday, 15 April 1998 at 12 noon EST. Please call in to the conference call using the same telephone number and code as for our standard Friday calls.

Should you have any questions before the conference call, please feel free to call (215) 788-7844, extension 237 for Charles Gaffney or extension 222 for me.

Very truly yours,

G.J. Anastos, Ph.D., P.E.
Project Manager

enclosure

cc: R Ball, Trustee
N Bernstein, Trustee
J Borucki, Versar
V Britton, Versar
M Dowiak, Radian
C Gaffney, Versar
T Harrison, CH2M Hill
R Hutchinson, ENVIRON
J Kyle, Trustee

Versar reported on Tasks 1, 2 and 3 (Geohydrological Data) of the Hot Spot Work Plan, dated 9 March 1998, in the Preliminary Hot Spot Report which was submitted as Appendix E of the Geotechnical Survey of the Southern Concrete Pad Area, dated 8 April 1998. The results for Task 4, Pilot Study, are discussed herein.

As part of the hot spot evaluation, two injection wells were installed for subsequent injection of the Fenton reagent as described in the Hot Spot Work Plan (dated March 9, 1998). These wells were designated as IW-1 and IW-4. A sample was collected from each of these wells, and a headspace analyses was conducted utilizing a photo-ionization detector (PID) to determine which sample would be submitted for a pilot/treatability analyses. The sample with the highest headspace concentration (175 vppm) was IW-4, and as a result, it was submitted for study to ISOTEC's treatability laboratory located in Lawrenceville, New Jersey.

Results of the laboratory study indicated a 94% total destruction of volatile compounds in the sample collected using ISOTEC's proprietary oxidation method (Fenton reagent) during one application during the treatability study.[1]

The pilot study on the organic contaminants on the IW-4 aqueous sample consisted of the following activities.

- the contaminants were identified (laboratory results are attached), and
- the contaminated samples were run through a series of oxidation pilot studies, (see Hot Spot Work Plan dated 9 March '98, Task 4 for details on the pilot studies).

Based on successful pilot study results, a specific initial treatment program can be implemented on the hot spots.

Treatability Study

The aqueous sample identified as IW-4 was collected on March 20, 1998 and shipped to ISOTEC's treatability laboratory. The sample was subjected to a series of studies using a Fenton reagent process to first evaluate whether the Fenton reagent process could successfully treat the contamination; and second, if the process was successful, to determine the optimum oxidation

[1] Based on the time constraints imposed on this project, only one application was conducted during the treatability study. However, based on the result of the first application, and our past experience, we anticipate that subsequent applications would reduce the contaminant concentration further and eventually to non-detectable concentrations.

conditions and stoichiometry based on the detected contaminants. The sample was further analyzed by a certified laboratory via EPA Method 624+10 to determine the effects of the oxidation process on the contaminants of concern. Results of the laboratory study indicated up to a 94% destruction of organic compounds detected within the sample during one treatment application.[2] Table 1 presents a summary of the treatability study. The complete laboratory hard copies are also attached.

Results of the treatability study indicated that ISOTEC catalyst 3000 achieved superior organic contaminant destruction compared to ISOTEC catalyst 4030. The catalysts consist of a proprietary chelated iron complex applied at a specific stoichiometry determined within the treatability study. Hydrogen peroxide was also utilized within their oxidizer. The oxidant and catalysts generate hydroxyl radicals, which react with the organic contaminants within the ground water, producing carbon dioxide and water as a by-product.

Preliminary screening of the treatability study sample indicated a significantly high pH of 11.4 in the sample. Adjustment of pH of the sample in the pilot study was not performed to assure that the pilot study reflected actual field conditions. We found that the ISOTEC catalyst 3000 performed better because it's formulation (iron suspended in an acid medium) reacted with the treatability sample to allow for more efficient degradation of the concentrated organics. The stoichiometry determined in the treatability study will be used to develop the Fenton reagent formulation for the initial treatment on the hot spots.

Recommended Treatment Program

Based on the successful treatability study conducted with the Fenton reagent (94% reduction of contaminants), an initial treatment program can be performed at the subject site to substantially reduce the organic loading in the areas treated. The treatment program, as described in the Hot Spot Plan, dated 9 March '98, will consist of :

- **Evacuation of Concentrated Organics (Task 5)** - The majority of the concentrated organics will be pumped from the two sand lens utilizing the extraction/injection wells installed in Task 3. The extracted concentrated organics will be pre- treated on-site with Fenton reagent in portable storage tanks (estimated extraction volume is approximately 650 gallons) and then discharged to the on-site wastewater treatment system for final treatment before discharge to Unnamed Creek.

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[2]This is conservative because as noted below the pH on the sample in the pilot study was not adjusted. The adjustment of the pH should have increased the destruction efficiency. Use of the ISOTEC 3000 series catalysts during the first in-situ injection should lower the pH and also increase the destruction efficiency.

- **In-Situ Treatment (Task 6)** - ISOTEC's proprietary blend of catalysts, oxidizer and mobility control agents will be injected into the sand lens to treat any residual concentrated organics that were not pumpable in Task 5. The extent of treatment during the initial application should destroy the majority of the contaminants of concern, however, additional treatments may be required to reach regulatory clean-up limits. This determinations will be made as described in the field during the monitoring program described in the Hot Spot Work Plan's Task 7, dated March 9, 1998.

Schedule

The following milestones are anticipated, assuming approval by USEPA and IDEM by 15 April:

- Mobilization to site and commence extraction of the concentrated organics week of 20 April
- On-site treatment of extracted concentrated organics week of 20 April
- Injection of Fenton reagent week of 20/27 April
- Sampling of injection well approximately one week after injection of the Fenton reagent
- Follow-up re-injection of the Fenton reagent approximately two weeks after sampling of the injection wells, if required
- Follow-up sampling approximately one week after the second injection of the Fenton reagent, if required

Table 1

Enviro-Chem Superfund Site
Zionsville, Indiana
Original vs. Treated Sample Results (IW-4)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,1-Dichloroethene	154	95	42	11
Methylene Chloride	208	179	111	<20
1,1-Dichloroethane	3210	2600	1230	<10
1,1,1-Trichloroethane	3400	2700	1130	393
Trichloroethene	498	429	<20	<10
Total VOs	7470	6003	2513	404
Total TICs	800	720	ND	ND
Total VOs and TICs	8270	6723	2513	404
% Destruction (total)	NA	NA	63%	94%

ppb - parts per billion (ug/l)
TICs - tentatively identified compounds
< - less than applicable laboratory detection limit
ND - not detected
NA - not applicable

C:\DOCS\ENVIROCH\tbsptice.wpd

Attachment
Laboratory Results

Integrated Analytical Laboratories, LLC.
273 Franklin Road
Randolph, N.J. 07869
973 361-4252
Fax: 973 989-5288

ANALYTICAL DATA REPORT

for

Isotec
51A Everett Drive
Lawrenceville,NJ 08648

Project Name: SMC/CERCLA INDIANA - 800014
Lab Case Number: 10980-1520

MDL = METHOD DETECTION LIMIT

Volatiles

Lab ID: 1520-005
Client ID: IW-4/3000T
Matrix-Units: Aqueous-µg/L
Percent Moisture: 100

Date Sampled: 3/26/98
Time Sampled: 12:00
Date Analyzed: 3/27/98

Compound	Conc	Q	MDL
Chloromethane	ND		10
Vinyl Chloride	ND		10
Bromomethane	ND		10
Chloroethane	ND		10
Trichlorofluoromethane	ND		10
1,1-Dichloroethene	11.3		10
Methylene Chloride	ND		20
trans-1,2-Dichloroethene	ND		10
1,1-Dichloroethane	ND		10
Chloroform	ND		10
1,1,1-Trichloroethane	393		10
Carbon Tetrachloride	ND		10
1,2-Dichloroethane(EDC)	ND		10
Benzene	ND		5
Trichloroethene	ND		10
1,2-Dichloropropane	ND		10
Bromodichloromethane	ND		10
2-Chloroethylvinyl Ether	ND		10
cis-1,3-Dichloropropene	ND		10
Toluene	ND		10
trans-1,3-Dichloropropene	ND		10
1,1,2-Trichloroethane	ND		10
Tetrachloroethene	ND		10
Dibromochloromethane	ND		10
Chlorobenzene	ND		10
Ethylbenzene	ND		10
Total Xylenes	ND		10
Bromoform	ND		10
1,1,2,2-Tetrachloroethane	ND		10
1,3-Dichlorobenzene	ND		10
1,4-Dichlorobenzene	ND		10
1,2-Dichlorobenzene	ND		10
TOTAL VO's:	404.3		
TOTAL TIC's:	ND		
TOTAL VO's & TIC's:	404.3		

ND = Analyzed for but Not Detected at the MDL

All required protocols were followed during analyses. These data have been reviewed and accepted by:

Michael H. Leffler, Ph.D
Laboratory Director

Integrated Analytical Laboratories, LLC.
273 Franklin Road
Randolph, N.J. 07869
973 361-4252
Fax 973 989-5288

ANALYTICAL DATA REPORT

for

Isotec
51A Everett Drive
Lawrenceville,NJ 08648

Project Name: SMC/CERCLA INDIANA - 800014
Lab Case Number: 10980-1520

MDL = METHOD DETECTION LIMIT

Volatiles

Lab ID: 1520-004
Client ID: IW-4/4030T-B
Matrix-Units: Aqueous-µg/L
Percent Moisture: 100

Date Sampled: 3/26/98
Time Sampled: 12:00
Date Analyzed: 3/30/98

Compound	Conc	Q	MDL
Chloromethane	ND		20
Vinyl Chloride	ND		20
Bromomethane	ND		20
Chloroethane	ND		20
Trichlorofluoromethane	ND		20
1,1-Dichloroethene	41.6		20
Methylene Chloride	111		40
trans-1,2-Dichloroethene	ND		20
1,1-Dichloroethane	1230		20
Chloroform	ND		20
1,1,1-Trichloroethane	1130		20
Carbon Tetrachloride	ND		20
1,2-Dichloroethane(EDC)	ND		20
Benzene	ND		10
Trichloroethene	ND		20
1,2-Dichloropropane	ND		20
Bromodichloromethane	ND		20
2-Chloroethylvinyl Ether	ND		20
cis-1,3-Dichloropropene	ND		20
Toluene	ND		20
trans-1,3-Dichloropropene	ND		20
1,1,2-Trichloroethane	ND		20
Tetrachloroethene	ND		20
Dibromochloromethane	ND		20
Chlorobenzene	ND		20
Ethylbenzene	ND		20
Total Xylenes	ND		20
Bromoform	ND		20
1,1,2,2-Tetrachloroethane	ND		20
1,3-Dichlorobenzene	ND		20
1,4-Dichlorobenzene	ND		20
1,2-Dichlorobenzene	ND		20
TOTAL VO's:	2512.6		
TOTAL TIC's:	ND		
TOTAL VO's & TIC's:	2512.6		

ND = Analyzed for but Not Detected at the MDL

Integrated Analytical Laboratories, LLC.
273 Franklin Road
Randolph, N.J. 07869
973 361-4252
Fax: 973 989-5288

ANALYTICAL DATA REPORT

for

Isotec
51A Everett Drive
Lawrenceville,NJ 08648

Project Name: SMC/CERCLA INDIANA - 800014
Lab Case Number: 10980-1520

MDL = METHOD DETECTION LIMIT

Volatiles

Lab ID: 1520-002
Client ID: IW-4/NT
Matrix-Units: Aqueous-µg/L
Percent Moisture: 100

Date Sampled: 3/26/98
Time Sampled: 12:00
Date Analyzed: 3/27/98

Compound	Conc	Q	MDL
Chloromethane	ND		100
Vinyl Chloride	ND		100
Bromomethane	ND		100
Chloroethane	ND		100
Trichlorofluoromethane	ND		100
1,1-Dichloroethene	95.3	J	100
Methylene Chloride	179	J	200
trans-1,2-Dichloroethene	ND		100
1,1-Dichloroethane	2600		100
Chloroform	ND		100
1,1,1-Trichloroethane	2700		100
Carbon Tetrachloride	ND		100
1,2-Dichloroethane(EDC)	ND		100
Benzene	ND		50
Trichloroethene	429		100
1,2-Dichloropropane	ND		100
Bromodichloromethane	ND		100
2-Chloroethylvinyl Ether	ND		100
cis-1,3-Dichloropropene	ND		100
Toluene	ND		100
trans-1,3-Dichloropropene	ND		100
1,1,2-Trichloroethane	ND		100
Tetrachloroethene	ND		100
Dibromochloromethane	ND		100
Chlorobenzene	ND		100
Ethylbenzene	ND		100
Total Xylenes	ND		100
Bromoform	ND		100
1,1,2,2-Tetrachloroethane	ND		100
1,3-Dichlorobenzene	ND		100
1,4-Dichlorobenzene	ND		100
1,2-Dichlorobenzene	ND		100
TOTAL VO's:	6008.3	J	
TOTAL TIC's:	720		
TOTAL VO's & TIC's:	6723.3	J	

ND = Analyzed for but Not Detected at the MDL
J = The concentration was detected at a value below the MDL
All qualifiers on individual Volatiles are carried down through summation.

Integrated Analytical Laboratories, LLC.
273 Franklin Road
Randolph, N.J. 07869
973 361-4252
Fax: 973 989-5288

ANALYTICAL DATA REPORT
for
Isotec
51A Everett Drive
Lawrenceville,NJ 08648
Project Name: SMC/CERCLA INDIANA - 800014
Lab Case Number: 10980-1520

MDL = METHOD DETECTION LIMIT

Volatiles

Lab ID: 1520-001
Client ID: IW-4
Matrix-Units: Aqueous-µg/L
Percent Moisture: 100

Date Sampled: 3/20/98
Time Sampled: 12:45
Date Analyzed: 3/27/98

Compound	Conc	Q	MDL
Chloromethane	ND		100
Vinyl Chloride	ND		100
Bromomethane	ND		100
Chloroethane	ND		100
Trichlorofluoromethane	ND		100
1,1-Dichloroethene	154		100
Methylene Chloride	208		200
trans-1,2-Dichloroethene	ND		100
1,1-Dichloroethane	3210		100
Chloroform	ND		100
1,1,1-Trichloroethane	3400		100
Carbon Tetrachloride	ND		100
1,2-Dichloroethane(EDC)	ND		100
Benzene	ND		50
Trichloroethene	498		100
1,2-Dichloropropane	ND		100
Bromodichloromethane	ND		100
2-Chloroethylvinyl Ether	ND		100
cis-1,3-Dichloropropene	ND		100
Toluene	ND		100
trans-1,3-Dichloropropene	ND		100
1,1,2-Trichloroethane	ND		100
Tetrachloroethene	ND		100
Dibromochloromethane	ND		100
Chlorobenzene	ND		100
Ethylbenzene	ND		100
Total Xylenes	ND		100
Bromoform	ND		100
1,1,2,2-Tetrachloroethane	ND		100
1,3-Dichlorobenzene	ND		100
1,4-Dichlorobenzene	ND		100
1,2-Dichlorobenzene	ND		100
TOTAL VO's:	7470		
TOTAL TIC's:	800		
TOTAL VO's & TIC's:	8270		

Metals

Lab ID: 1520-001
Client ID: IW-4
Matrix-Units: Aqueous-mg/L
Percent Moisture: 100

Date Sampled: 3/20/98
Time Sampled: 12:45
Date Analyzed: 4/1/98

Parameter	Result	Q	MDL
Iron	ND		0.050

ND = Analyzed for but Not Detected at the MDL

INTEGRATED ANALYTICAL LABORATORIES
CHAIN OF CUSTODY

CLIENT & PROJECT

Customer: ISOTEC
Address: 51A Everett Drive, Lawrenceville, NJ 08512
Telephone: 609-275-8500
FAX: 609-275-9608
Project Name: SMC/CERCLA, Indian
Project Manager: Tom Andrews
Reference: B000l4 POR 1125

MAILING & BILLING

Send Report To: Prasad Kakarla
Address: — Same —
Send Invoice To:
Address: Parsippany

Turnaround Time

Conditional / TEHC: 24 hr, 48 hr, 72 hr, 1 wk, NA, Other:
Verbal/Fax: 24 hr, 48 hr, 72 hr, (1 wk), 2 wk, Other:
Hard Copy: 72 hr, 1 wk, (2 wk), 3 wk, Other:
*Prior to sample arrival, Lab notification is required.

Report Format: (Standard), Regulatory, Reduced/Tier II, Other:

SAMPLE INFORMATION

Sample Matrix: A - Aqueous, S - Soil, SL - Sludge, W - Waste, X - Other, O - Oil

Lab Case #: 1520

Sample ID	Sample Description	Date	Time			Matrix	# of Containers	Lab ID	(VOTID)	Fe, dissolved
IW-4	Monitoring	3/20	1245	✓		A	2+1	01		X
IW-4/NT	Lab study Control	3/26	1200	✓		A	2	2		
IW-4/403074	" Treated	3/26	1200	✓		A	2	3		
IW-4/4030 FB	" Treated	3/26	1200	✓		A	2	4		
IW-4/3000 T	" Treated	3/26	1200	✓		A	2	5	✓	

ANALYTICAL REQUESTS / PRESERVATIVES

Preservatives: (1. HCl), 2. HNO3, 3. NaOH, 4. H2SO4, 5. Other, 6. Other

Cooler Temp.: 4°C

Concentration Expected: LOW (MED) HIGH

Known Hazard: (yes) No

Describe:

CUSTODY LOG

Sign	Date	Time			Organization	Reason
Relinquished: [signature]	3/26/98	1200		✓	ISOTEC	To Lab
Received: [signature]	3-26-98	1729	✓		[signature]	
Relinquished: [signature]	3-26-98	19:24	✓		[signature]	
Received: IAL Aldridge	3/26/98	1938		✓	IAL	
Relinquished: IAL Aldridge	3/27/98	800	✓		IAL	
Received: Gail Carnevale	3/27/98	800	✓		IAL	ANALYSIS

Comments: Chlorinated contamination. Control (IW-4/NT) and straight sample (IW-4) may have high conc. Treated samples may have lower conc. For Fe, dissolved, filter & preserve before analysis

1520

PAGE 1 OF 1

LAB COPIES - WHITE & YELLOW; CLIENT COPY - PINK

CHAIN OF CUSTODY

Case No.: 10980-1520 P.O. #: 1125
Project : SMC/CERCLA INDIANA - 800014
Client/Project: ISOTEC/SMC/CERCLA INDIANA

Client Address:
Isotec
51A Everett Drive
Lawrenceville, NJ 08648

Billing Address:
Isotec
51A Everett Drive
Lawrenceville, NJ 08648

Date Received: 03/27/98
Time Received: 08:00
Report Format: Standard
Verbal Due: Apr 3
Report Due: Apr 10

# of Containers	3	2	2	2	2
IAL ID #	1520-001	1520-002	1520-003	1520-004	1520-005
Client ID #	IW-4	IW-4/NT	IW-4/403	IW-4/403	IW-4/300
			OT-A	OT-B	OT
Matrix	Aqueous	Aqueous	Aqueous	Aqueous	Aqueous
Sample Date	03/20/98	03/26/98	03/26/98	03/26/98	03/26/98
Sample Time	12:45	12:00	12:00	12:00	12:00
VO + 10	✓	✓	✓	✓	✓
Fe-Iron	✓				

Comments: NOTE 1: SAMPLES #1 & #2 MAY HAVE HIGH CONCENTRATIONS.
SAMPLES #3 - #5 MAY HAVE LOWER CONCENTRATIONS.
NOTE 2: IRON TO BE FILTERED & PRESERVED IN LAB.

Integrated Analytical Laboratories, Inc.

Laboratory Custody Chronicle

Case No : 10980-1520 Date sampled from: 03/20/98 to: 03/26/98
Client : Isotec Date Received : 03/27/98
Project : SMC/CERCLA INDIANA - 800014

Custody Seal	Present/(Absent)
	Intact/Not Intact
Chain of Custody	(Present)/Absent
Sample Tags	(Present)/Absent
	(Listed)/Not Listed on C.O.C
Shipping Bill	Present/(Absent) No._____
Cooler Conditions	4°C Temp
Sample(s) Conditions	_____

	GC/MS V		EXTRACT DATE	EXTRACT TIME	EXTRACT INITIAL	ANALYSIS DATE	ANALYSIS TIME	ANALYSIS INITIAL
VO + 10	1520-001	A				3/27/98	820-411	DST
	1520-002	A						
	1520-003	A						
	1520-004	A						
	1520-005	A						
	METALS							
Fe-Iron	1520-001	A	3/31/98	ofnd.		4/1	800	JT

REVIEW & APPROVAL: [signature]
REMARKS :

Remedial Progress (Enviro-Chem) ppb												
Compound	IW-1					IW-4					Clean-up Standards (ppb)	
	Before	May 6, 1998	May 14, 1998	May 28, 1998	Overall % Reduction	Before	May 6, 1998	May 14, 1998	May 28, 1998	Overall % Reduction	Groundwater	Soil
1,1-Dichloroethene	1780	138	66.23	ND	-100	51.3	12.7	ND	ND	-100	*7*	*762*
1,2-Dichloroethene	39.9	830	892.28	1800	+4,411	26.3	667	390	18000	+68,341	*70*	*5782*
Ethyl benzene	344	ND	ND	ND	-100	ND	ND	ND	ND	----	*680*	*207464*
Methylene Chloride	3180	713	746.59	B	B	211	187	87.35	B	B	*47*	*126*
Tetrachloroethene	41.5	3.11	ND	ND	-100	ND	1.30	ND	ND	----	*0.69*	*77*
Toluene	2760	97.79	106	280	-90	16.4	4.11	ND	1700	+10,266	*2000*	*546134*
1,1,1-Trichloroethane	33100	2240	3262.86	6000	-82	2690	768	385.3	19000	+606	*200*	*47871*
1,1,2-Trichloroethane	118	11.8	13.21	ND	-100	10.4	11.7	ND	ND	-100	*0.61*	*71*
Trichloroethene	29400	1540	4300	10000	-66	414	62.2	27.8	1400	+238	*5*	*812*
Vinyl Chloride	79.6	37.9	13.59	ND	-100	ND	13.4	31.13	4800	+100+	*2*	*8.3*

Notes: A positive reduction indicates an increase of concentration.
B - Detected in Laboratory Blank

Down Gradient Well (W-5)

Recra LabNet - Cleveville Laboratory
Volatiles By GC/MS, Special List

Report Date: 06/05/98 13:48

RLN Batch Number: 9805L891 Client: [redacted] Work Order: 0170960010C Page: 1a

	Cust ID:	ENVIROCHEM/I W-1		ENVIROCHEM/I W-4		ENVIROCHEM/I W-5		TRIP BLANK		VOLAV2	
Sample Information	RLN#:	801		802		803		804		9805VX34B-MB1	
	Matrix:	WATER		WATER		WATER		WATER		WATER	
	D.F.:	50.0		25		25.0		1.00		1.00	
	Units:	UG/L		UG/L		UG/L		UG/L		UG/L	
Surrogate Recovery	1,2-Dichloroethane-d4	93	%	95	%	94	%	94	%	96	%
	Toluene-d8	108	%	97	%	106	%	105	%	103	%
	Bromofluorobenzene	97	%	104	%	104	%	105	%	102	%
Vinyl Chloride		500	U	4800		240	J	10	U	10	U
Methylene Chloride		1100	B	410	JB	280	B	11	B	14	
1,1-Dichloroethene		71	J	170	J	50	U	2	U	2	U
1,2-Dichloroethene (total)		1800		18000		2400		2	U	2	U
1,1,1-Trichloroethane		6000		19000		110	U	5	U	5	U
Trichloroethene		10000		1430		110	U	5	U	5	U
1,1,2-Trichloroethane		250	U	620	U	110	U	5	U	5	U
Tetrachloroethene		250	U	620	U	110	U	5	U	5	U
Toluene		280		1730		110	U	5	U	5	U
Ethylbenzene		250	U	620	U	110	U	5	U	5	U

** Outside of EPA CLP QC limits.

APPENDIX E

Versar's Fenton Reagent Injection Analytical Results

Versar INC.

21 July '99

Myron Walters
IDEM
100 North Senate Avenue
P.O. Box 6015
Indianapolis, IN 46206-6015

Michael McAteer
USEPA, HSEW-6J
77 West Jackson Blvd.
Chicago, IL 60604-3590

Re: Enviro-Chem RRA Zionsville Indiana
Hot Spot # 1 and 2 Sampling Data Summary

Sent Via Fax

Dear Sirs:

As per your request, Versar encloses a summary of data on Hot Spots # 1 and 2. Please note that laboratory problems invalidate the December 30th, 1998 results because the data was grossly outside QA/QC parameters and subsequent redilutions where taken from sample bottles which had headspace in them. The February 5th, 1999 data, although valid, had detection limits which where higher than Revised Exhibit A evaluation standard for 17 analytes due to the high concentrations of several analytes.

If you have any questions, please feel free to call me at (215) 788-7844, Extension 222

Very truly yours,

G. J. Anastos, Ph.D., P.E.
Project Manager

cc: R. Ball (ENVIRON)
N. Bernstein (NWB & A)
T. Harrison (CH2M Hill)

J:Common\Envchem\HotSpotSum.wpd

Table 1: Pre and Post Fenton Reagent Injection Groundwater Sampling Results, Hot Spot Areas, Enviro-Chem, Zionville, Indiana

Location	Analytes of Concern (all data in ppb)	Apr. 24, 1998 (Before 1st HS-1/HS-1A Injection)	May 6, 1998 (After 1st HS-1/HS-1A Injection)	May 14, 1998 (Before 2nd HS-1/HS-1A Injection)	May 28, 1998 (After 2nd HS-1/HS-1A Injection)	Nov. 10, 1998 (HS-2 Pump Test Purge Water/ 1st 4,000 gals)	Nov. 13, 1998 (HS-2 Pump Test Purge Water/ 1st 15,000 gals)	Dec. 14, 1998 (Before 3rd HS-1/1A & 1st HS-2 Injection)	Dec. 30, 1998[1] (After 3rd HS-1/1A & 1st HS-2 Injection)	Feb. 5, 1999[2] (After 3rd HS-1/1A & 1st HS-2 Injection)	Cleanup Criteria Table 3-1 (ppb)
Well HS-1	1,1 Dichloroethene	1,780	138	66.2	ND	NA	NA	38,000	<100	<2,000	7.0
	1,2-Dichloroethene	39.9	830	892	1,800	NA	NA	110	<100	<2,000	70
	Ethylbenzene	344	ND	ND	ND	NA	NA	58	<100	<2,000	680
	Methylene chloride	3,180	713	746	B	NA	NA	12,000	170	6,000	4.7
	Tetrachloroethene	41.5	3.1	ND	ND	NA	NA	6.2	<100	<2,000	0.69
	Toluene	2,760	97.8	106	280	NA	NA	550	<100	<2,000	2,000
	1,1,1-Trichloroethane	33,100	2,240	3,262	6,000	NA	NA	13,000	38	9,100	200
	1,1,2-Trichloroethane	118	11.8	13.2	ND	NA	NA	130	<100	<2,000	0.61
	Trichloroethene	29,400	1,540	4,300	10,000	NA	NA	1,100	<100	3,900	5.0
	Vinyl chloride	79.6	37.9	13.5	ND	NA	NA	150	<40	<800	2.0
Well HS-1A	1,1 Dichloroethene	51.3	12.7	ND	ND	NA	NA	<400	<10,000	<400	7.0
	1,2-Dichloroethene	26.3	667	390	18,000	NA	NA	8,300	8,000	10,000	70
	Ethylbenzene	ND	ND	ND	ND	NA	NA	64	<10,000	<400	680
	Methylene chloride	211	187	87.3	B	NA	NA	910	<20,000	<800	4.7
	Tetrachloroethene	ND	1.3	ND	ND	NA	NA	28	<10,000	<400	0.69
	Toluene	16.4	4.1	ND	1,700	NA	NA	<400	<10,000	<400	2,000
	1,1,1-Trichloroethane	2,690	768	385	19,000	NA	NA	2,200	3,600	24,000	200
	1,1,2-Trichloroethane	10.4	11.7	ND	ND	NA	NA	<400	<10,000	<400	0.61
	Trichloroethene	414	82.2	27.8	1,400	NA	NA	250	<10,000	3,300	5.0
	Vinyl chloride	ND	13.4	31.1	4,800	NA	NA	<160	<4,000	<160	2.0
Well HS-2	1,1 Dichloroethene	NA	NA	NA	NA	33	54	NA	<400	4.9	7.0
	1,2-Dichloroethene	NA	NA	NA	NA	4,130	4,480	NA	<400	781	70
	Ethylbenzene	NA	NA	NA	NA	120	110	NA	<400	30	680
	Methylene chloride	NA	NA	NA	NA	<10	110	NA	<800	27	4.7
	Tetrachloroethene	NA	NA	NA	NA	6.0	8.8	NA	<400	<5.0	0.69
	Toluene	NA	NA	NA	NA	1,600	<5.0	NA	<400	99	2,000
	1,1,1-Trichloroethane	NA	NA	NA	NA	310	1,000	NA	<400	93	200
	1,1,2-Trichloroethane	NA	NA	NA	NA	<5.0	<5.0	NA	<400	<5.0	0.61
	Trichloroethene	NA	NA	NA	NA	<5.0	<5.0	NA	<400	<5.0	5.0
	Vinyl chloride	NA	NA	NA	NA	780	1,700	NA	<160	<2.0	2.0

[1] December 30, 1998 data are invalid because QA/QC indicators were exceeded. Furthermore, dilutions were made from samples with headspace, so results are biased low.

[2] February 5, 1999 detection limits on 17 analytes exceeded applicable site cleanup criteria. The work was performed at the laboratory's expense.

ppb = parts per billion

NA = not applicable

ND = not detected

B = detected in laboratory blank

? = inconclusive due to high detection limit

APPENDIX F

Versar's Preliminary Hot Spot Report

Preliminary Hot Spot Report
Enviro-Chem Superfund Site
Zionsville, Indiana

March 26, 1998

Versar Inc.

Table of Contents

Introduction

This report presents the preliminary results of the hot spot treatment investigation at the Enviro-Chem Site located in Zionsville, Indiana. As part of this treatment investigation, five soil borings were advanced in the southwest corner of the Southern Concrete Pad Area; wells were installed in two of the borings; groundwater samples were collected for CLP analyses (full priority pollutant list) from the two wells; and a sample was collected for a pilot study for the recommended remediation (Fenton reagent/in-situ oxidation), see Versar's Hot Spot Work Plan dated 9 March.

This report focuses on only the geology of the hot spot area and the extent of the concentrated organics in relation to the geology. The information is presented graphically on Figures 1 and 2. A final report will be submitted once the results of the pilot test and the ground water sample analyses are received.

Background

During the advancement of the Southern Concrete Pad Geotechnical Survey's borings (G-1 through G-18) at the Enviro-Chem site, unexpected concentrated organics were encountered below six feet in soil borings G-17 and G-18. Based on these borings, the extent of the concentrated organics appeared to be limited and subsurface characteristics suggested that a Fenton reagent would be an appropriate method of treatment for the hot spots. Versar developed a work plan (dated March 1998) to address the hot spots.

Field Investigation

An initial soil exploration boring, designated as TB-1 (Test Boring -1), was advanced at the location shown on Figure 1. Originally, this boring was to be advanced in an uncontaminated area north of G-18, however, due to significant water and ice on the concrete pad at the time of drilling, the location was changed to a dry and uncontaminated area east of G-18 as shown on Figure 1. The purpose of this boring was to characterize the underlying stratigraphy proximate to the "hot spot."

In addition, based on the anticipated extent of concentrated organics in the hot spots (determined during the Southern Concrete Pad Geotechnical Survey), four boreholes were advanced in the area of the hot spot and were designated as IW-1 through IW-4 (Injection Well) at the locations shown on Figure 1. The purpose of these boreholes was to intercept the zone of concentrated organics (based on PID measurements and visual observations) and to install well screens in the appropriate interval to allow withdrawal of groundwater and subsequent injection of chemical oxidants for treatment purposes. Water bearing sand units with associated concentrated organics were encountered in boreholes IW-1 and IW-4 only. No significant water or concentrated organics were encountered in boreholes IW-2 and IW-3, and as a result, these two boreholes were grouted to the

surface in accordance to Indiana Department of Environmental Management (IDEM) guidelines. Four-inch diameter wells were installed in boreholes IW-1 and IW-4.

Prior to advancing the five boreholes, a 12-inch diameter casing was installed to a depth of six feet below the ground surface to prevent potential cross-contamination from the upper five feet of contaminated soils (identified by previous evaluations). Hollow stem auger drilling methodologies were utilized coupled with continuous split spoon sampling in each of drilling locations. All split-spoon samples were logged geologically and field screened for volatile organic vapors using an HNu Photo-Ionization Detector calibrated to an isobutylene standard. Four-inch diameter PVC casing and well screen (0.020 slot size) with a bottom cap were installed in boreholes IW-1 and IW-4. A sand pack was added to approximately one foot above the screened interval. A two-foot bentonite seal was placed on top of the sand pack, and the remaining annular space was grouted with a cement and bentonite slurry. The wells were completed with concrete base, protective casing, and locking caps. Drill cuttings were containerized in 55-gallon drums and stored on-site for subsequent incorporation into the SVE treatment area.

The two newly installed monitoring wells were developed utilizing air sparging equipment (30 to 40 pounds per square inch of pressure) and hand bailing. Well IW-1 was bailed dry and did not have any significant recovery over a period of five hours. However, after three days, the water level was approximately 10 feet below the ground surface. Well IW-4 was bailed dry (after approximately three well volumes had been removed). After two hours, the water level appeared to stabilize at 18.5 feet below the ground surface. Purge water was containerized in 55-gallon drums and stored on-site for subsequent treatment in the on-site WWT system prior to discharge.

During the boring program, attention was focused on the moisture content in each of the samples, the specific soil classification of the sample, the static water level in the borehole, any changes in water level, and evidence of concentrated organics. Drilling logs are presented in Appendix A (graphic logs and well construction details will be completed and provided in the final report).

Localized Geology

The stratigraphy underlying the hot spot is that of glacial deposition based on the erratic distribution of sediments, poorly sorted sands and gravels, and the intermixing of angular and well rounded surfaces on the gravel surfaces. A geologic cross section (Figure 2) has been prepared based on the geotechnical evaluation and hot spot evaluation soil borings. Four distinct lithological material types were encountered in the hot spot area as follows:

1) *Disturbed Grey and Brown Clay/Silt*

The upper 5 to 12 feet consisted of grey and brown clay, silt, fine to coarse sand, and gravel. The material ranged from moist to wet and was heavily mottled in areas. The material had a chemical

odor in some areas. Several of the split-spoon samples had evidence of wooden plant debris, which appeared to be relatively recent in age (not of glacial age), suggesting that this zone of material may not be naturally in-place (i.e. disturbed, excavated and re-compacted, etc.). This zone appeared to be excessively thick in the extreme southwestern corner of the concrete pad (borings IW-2 and G-17).

2) Grey Clay and Silt

This material is interbedded with the brown sand and gravel material (discussed below). Generally, this material is dry to damp, rarely wet, and was never saturated when encountered, suggesting that it acts as a relatively impermeable layer. It was often encountered with trace amounts of well rounded to angular, fine to coarse sand and gravel indicative of glacial deposition.

3) Brown Sand and Gravel

This material was interbedded with the grey clay and silt material (discussed above). This material consisted of a brown fine to medium, well rounded to angular sand and gravel. Generally the lenses that were encountered were not continuous and pinched in and out. The lenses were all saturated and appeared to be the migration pathways for the concentrated organics. It should be noted that in many of the borings the sand and gravel layers contained concentrated organics and the grey clay layers above and below the sand and gravel were clean (based on PID readings).

4) Brown Gravel

This material was encountered only in boring IW-3. Based on the borings conducted during the Southern Concrete Pad Geotechnical Survey, this gravel layer was typically encountered at a depth of 15 to 23 feet below the ground surface. It is apparent that this layer is not continuous under portions of the hot spot area since it was not encountered in boring TB-1 (total depth 40 feet). Generally, this gravel layer consists of brown fine to coarse, poorly sorted, well rounded to angular gravel which is saturated. Some fine to coarse sand was also encountered in this material, but the majority of the material was gravel. It is presumed that this is similar to the material that has been referred to as the "lower" or "deep" sand unit in previous reports.

Localized Hydrogeology

It was evident during the hot spot boring program that only the sand and gravel layers were saturated. The clay zones were dry to damp, suggesting that the sand and gravel layers appear as the only water bearing zones, while the clay zones act as confining layers. The most significant hot spots (based on PID measurements) were identified in the saturated sand and gravel zones, suggesting that these units represent the concentrated organics migration pathways.

The two wells that were installed (IW-1 and IW-4) were developed utilizing air sparging equipment (30 to 40 pounds per square inch of pressure) and hand bailing. The wells were left to stabilize for three days after the development process. The water in IW-1 stabilized at 10.0 feet below the ground surface, and IW-4 stabilized at 18.5 feet below the ground surface (see Figure 2). It is apparent that the sand layers drained into IW-1 because the top of the saturated sand lens encountered (screened) in IW-1 was approximately 10 feet below the ground surface. The screened sand layer in IW-4 was first encountered at approximately 18 feet below the ground surface, suggesting that the water level in this well is also a result of drainage from the intercepted saturated sand lens (see Figure 2).

Additional water levels will be recorded to further evaluate hydrogeologic characteristics, however, based on the data available to date, no evidence of artesian conditions have been encountered in the hot spot area. It should also be noted that no water table conditions have been identified to date; only perched water bearing zones were encountered.

Concentrated Organics Distribution

The majority of the concentrated organics material (based on PID measurements presented in Figure 2) in the hot spot area was encountered in the saturated, interbedded sand and gravel layers between 9 and 22 feet below the ground surface.[1] The source of these concentrated organics is not clear, however, the migration of the concentrated organics appears to be confined to the sand and gravel lenses. The sand and gravel units are not continuous, and as a result, the concentrated organics are not wide spread, but rather appear to be confined to the extent of the sand and gravel units. Figure 1 presents the interpreted lateral extent of the hot spots. It should be noted that the southern edge of the hot spots has not been clearly defined.

Based on visual observations and odors, two distinct and likely disconnected hot spots were identified:

- an upper hot spot located in a possibly interconnected sand and gravel zone between 9 and 16 feet below the ground surface, which had a strong chlorinated solvent odor; and
- a lower hot spot located between 17 and 21 feet below the ground surface, which had a very different odor (semi-volatile type compound) and appearance (brown oily compound).

---

[1] Concentrated organics were identified in the geotechnical boring G-18 below this depth, however, it is believed that this material may have been dragged down as a result of the drilling methodology that was utilized. The concentrated organics may still exist at the depth identified in G-18 (see Figure 2), and as a result, the well screen in IW-4 was extended to intercept this depth.

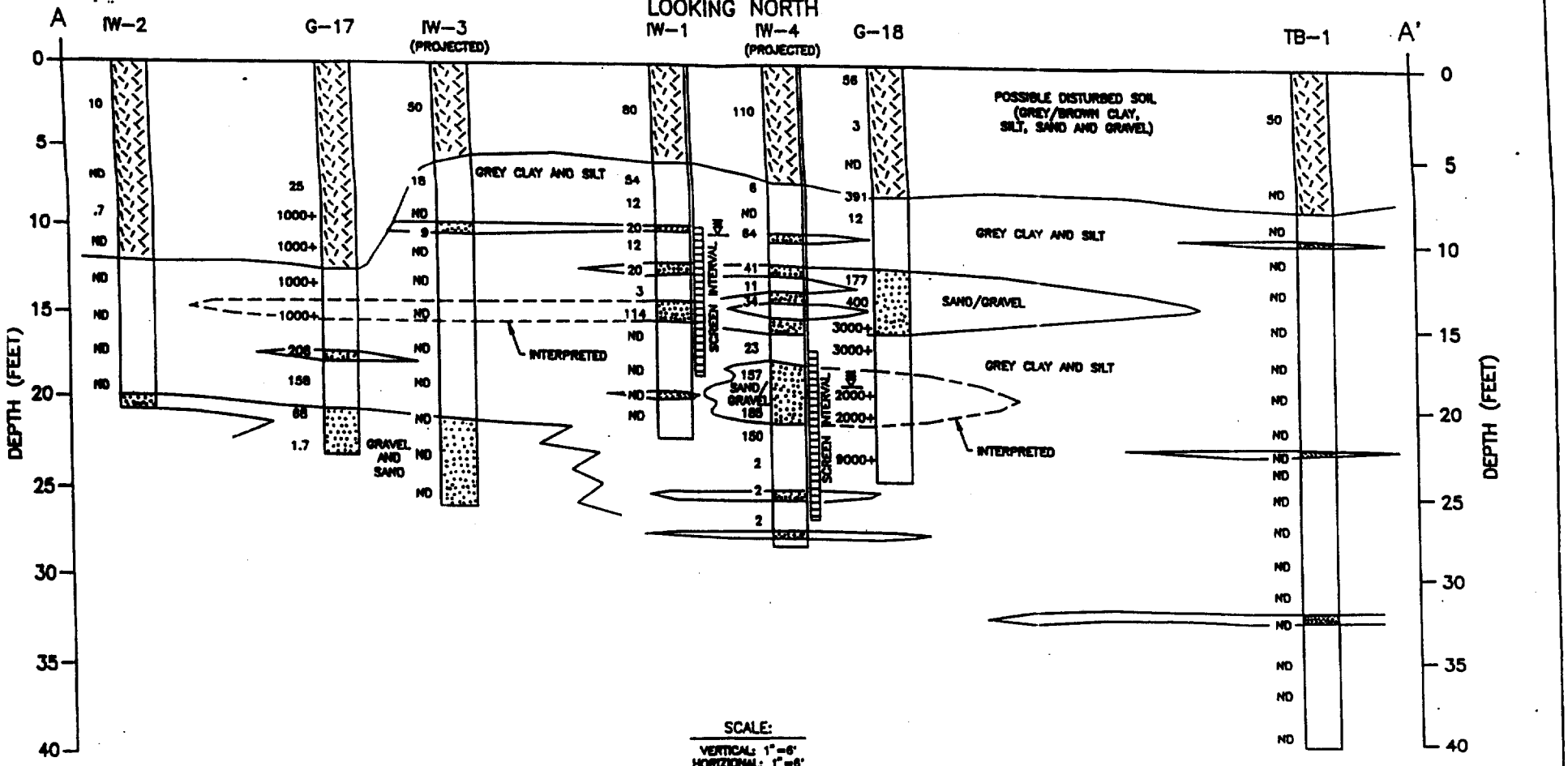
The grey clay layers which separate these hot spots appear to be clean (based on PID measurements), suggesting that the concentrated organics have been confined to the sand and gravel layers.

Remedial Program

Injection wells (IW-1 and IW-4) have been installed with screen depths that intercept the hot spot zones. IW-1 has been constructed to treat the upper hot spot (chlorinated solvents), and IW-4 has been constructed to treat the lower hot spot (semi-volatile type compound). Based on development information, the injection wells are well connected to the formation allowing appropriate withdrawal of concentrated organics and subsequent injection of the Fenton reagent. The original calculation identifying the amount of concentrated organics requiring treatment has been significantly reduced based on the extent of the hot spots identified.

FIGURES

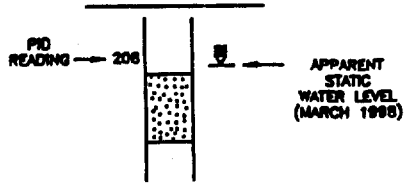
ENVIRO–CHEM HOT SPOT
GEOLOGIC CROSS SECTION
LOOKING NORTH



SCALE:
VERTICAL: 1"=6'
HORIZONTAL: 1"=6'

NOTE: SOME SAND LENSES HAVE BEEN PROJECTED BASED ON INTERPRETATIONS OF THE DATA. THE INTERPRETATIONS HAVE BEEN BASED ON UNITS THAT LIKELY EXIST IN BORINGS G–17 AND G–18, BUT WERE NOT IDENTIFIED BASED ON PREVIOUS DRILLING METHODOLOGIES.

EXPLAINATION

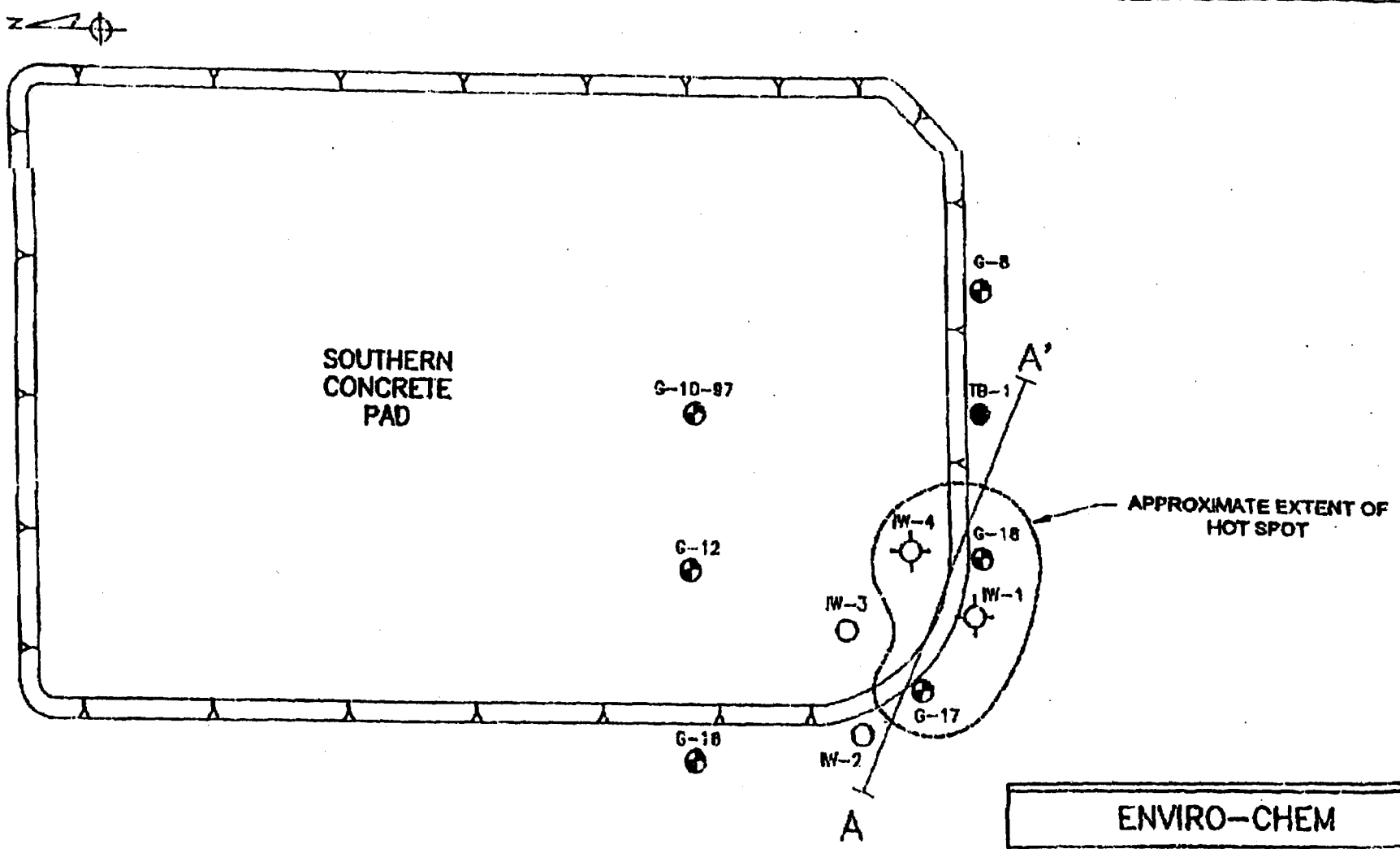


ENVIRO–CHEM

FIGURE 2
HOT SPOT GEOLOGIC CROSS SECTION

Versar
1900 FROST ROAD, SUITE 110
BRISTOL, PA 19007
(215)788-7844

SCALE: AS SHOWN | DATE: 3/23/98



NOTE: ONLY GEOTECHNICAL BORINGS IN THE SOUTHWESTERN CORNER ARE SHOWN. ADDITIONAL BORINGS ARE SHOWN IN GEOTECHNICAL REPORT.

LEGEND

- GEOTECHNICAL BORINGS
- HOT SPOT BOREHOLE (NO WELL INSTALLED)
- HOT SPOT BOREHOLE (WELL INSTALLED)
- INITIAL SOIL EXPLORATION BORING

ENVIRO-CHEM

FIGURE 1
HOT SPOT
SITE MAP

Versar Inc.
1900 FROST ROAD, SUITE 110
BRISTOL, PA 19007
(215)788-7844

SCALE: 1"=30' DATE: 3/23/98

APPENDIX G

Versar's Hot Spot #2 Pump Test Results

Versar INC.

December 8, 1998

Vince L. Epps
IDEM
100 North Senate Avenue
P.O. Box 6015
Indianapolis, IN 46206-6015

Michael McAteer
USEPA, HSRW-6J
77 West Jackson Blvd.
Chicago, IL 60604-3590

Re: Enviro-Chem RRA, Zionville, Indiana,
Results of Pumping Test Performed on Hot Spot #2 Well (Well HS-2)

Dear Sirs:

Recently Versar, Inc. (Versar) conducted a 120 hour pumping test on Hot Spot Well HS-2 located within the southern portion of the subject site, and conducted laboratory analyses on samples of the containerized pumping water. The work was performed in accordance with the October 7, 1998 *Revised Hot Spot #2 Work Plan* prepared by Versar on behalf of the Enviro-Chem Trust and submitted to Indiana Department of Environmental Management (IDEM) and the U.S. Environmental Protection Agency (USEPA). The purpose of the pumping test was to evaluate the possibility (if any) of a hydraulic connection between the two Hot Spot areas and/or the surrounding wells, and to assess the quality of the groundwater beneath the Hot Spot #2 area. The site plan/well location map is included as Figure 1.

Procedures

The Well HS-2 pumping test began on November 9, 1998, and lasted approximately 120 hours, ending on November 14, 1998. During the test, groundwater elevations were monitored within the pumping well (Well HS-2), the two Hot Spot #1 wells (Wells HS-1 and HS-1A), and surrounding on-site monitoring wells, specifically Wells S-2, S-3, T-9 and IW-5. Drill logs, including well construction diagrams, for the three hot spot wells (Wells HS-1, HS-1A, and HS-2) are included in Attachment A. The other wells were not installed by Versar.

Prior to the beginning of the pumping test, pressure transducers for a two channel In-Situ Hermit™ Data Logger were installed near the bottom of Wells HS-1 and HS-2 in order to collect water level measurement. Periodic manual water-level measurements were collected from all seven wells, including HS-1 and HS-2. The water level readings are included in Attachment B. Groundwater drawdown versus time plots of the water level readings are enclosed as Attachment C. Permeability calculations, including a semi-log plot of drawdown versus time for the pumping well (Well HS-2), are presented in Attachment D.

Based on yield values obtained during development of the recently installed Well HS-2, the pumping rate for the test was set at 2.5 gallons per minute (gpm). The intake of the pump, a Grundfos™ ReadyFlow2, was placed approximately one foot from the bottom of the 16 foot deep recovery well. An in-line flow meter was used to gauge the 2.5 gpm flow rate. The purge water was discharged into a clean Frac tank present at the site. Two samples of the stored purge water were collected within the first and last 24 hours of the test. The samples were collected from a manhole in the top of the Frac tank via disposable bailers, and were placed in laboratory-supplied containers. The two purge water samples, labeled FT and FT2, respectively, were placed on ice and delivered by courier to National Environmental Testing, Inc. (NET) of Indianapolis, Indiana for volatile organic compounds (VOCs) analysis using USEPA Method 8260. The laboratory analytical results are enclosed as Attachment E.

Results and Conclusions

Versar has the following results and conclusions based upon the compilation and assessment of the field observations and laboratory analytical results derived from the recent pumping test of Well HS-2 located within Hot Spot #2:

- A hydraulic connection was observed between the pumping well (Well HS-2) in Hot Spot #2 and the deeper of the two Hot Spot #1 wells (Well HS-1A).

  As indicated in the drawdown versus time plots for Wells HS-2 and HS-1A, the cone of groundwater depression associated with the pumping in Well HS-2 had a maximum sustained drawdown of approximately 1.0 foot in Well HS-2 and of approximately 0.6 foot in nearby Well HS-1A. Furthermore, the drawdown curves for both wells are similar in shape and response time.

- None of the remaining wells monitored during the pumping test, including Hot Spot #1 well (HS-1), were effected by the drawdown in Well HS-2, but all of the wells were affected by a local rain storm event.

  The drawdown curves for Wells HS-1, S-2, S-3, T-9 and IW-5 appeared unaffected by the pumping in Well HS-2. The only regional hydraulic impact to these wells was the groundwater recharge associated with two consecutive periods of heavy rain within one storm event, which commenced shortly after the initiation of the test and lasted approximately 16 hours. The effect that this storm had on the regional groundwater can be observed in all seven wells as a single or double "hump" in the well drawdown curves between approximately 0 minutes and 2,500 minutes (see Attachment C).

- Well HS-2 (Hot Spot #2 Well) yielded a flow of 2.5 gpm and an average hydraulic conductivity of 1.17×10^{-5} ft/sec in the saturated zone located at a depth of 13 to 16 feet within the well.

  The hydraulic conductivity for Well HS-2 was calculated from the log-log plot of hydraulic head versus time curve for the first 20 minutes of the pumping test (see Attachment E), prior to the onset of the rain storm event. The calculated hydraulic conductivity and observed yield for Well HS-2 are consistent with data collected during the installation of this well. Specifically, at a depth of 12 to 14 feet the well intersects a sand and gravel layer. The 1.17×10^{-5} ft/sec hydraulic conductivity is typical of sandy units (Freeze and Cherry, 1979), such as the one observed in the lower portion of Well HS-2.

- The samples collected from the purge water stored in the on-site Frac tank had elevated VOC concentrations in excess of the Acceptable Subsurface Water Concentrations included in *Revised Exhibit A* Table 3-1 Cleanup Standards.

  Concentrations of several VOCs including 1,1-dichloroethene, cis-1,2-dichloroethene, methylene chloride, trans-1,2-dichloroethene, tetrachloroethene, 1,1,1-trichloroethane, and vinyl chloride exceeded the Acceptable Subsurface Water Concentrations included in *Revised Exhibit A* Table 3-1 Cleanup Standards.

Recommendations

Based on the results of the pumping test and groundwater laboratory analyses, Versar has the following recommendations which are consistent with the October 7, 1998 *Revised Hot Spot #2 Work Plan*:

- Both hot spot areas and the Frac tank purge water will be treated with Fenton reagents. However, since a hydraulic connection exists between Wells HS-2 and HS-1, the Hot Spot #2 area will be treated three to six weeks prior to the Hot Spot #1 area. The water in the Frac tank will be treated at the same time as the Hot Spot #2 area, and will subsequently be pumped through the on-site water treatment system for polishing before being discharged.

- The effectiveness of the Fenton reagent treatment will be monitored via by-weekly sampling (for a period of two months) of Wells HS-2, HS-1 and HS-1A for VOCs, semi-volatile organic compounds (SVOCs), total organic carbon (TOC), dissolved oxygen (DO), redox potential, hydroxyl radical, pH, temperature, and conductivity.

- If residual organics remain in the wells of concern, a second Fenton reagent application will be considered upon an analysis of the data. The treatment effectiveness will be measured with respect to water samples taken from the hot spot and recovery wells that are assumed to be in equilibrium with soil compared to the Acceptable Subsurface Water Concentrations included in *Revised Exhibit A* Table 3-1 Cleanup Standards.

If you have any questions or comments please contact George at (215) 788-7844, extension 222.

Very truly yours,

/Bernard Stockar for

David V. Stockar, P.E.
Senior Hydrogeologist

Charles J. Raffaele
FOR

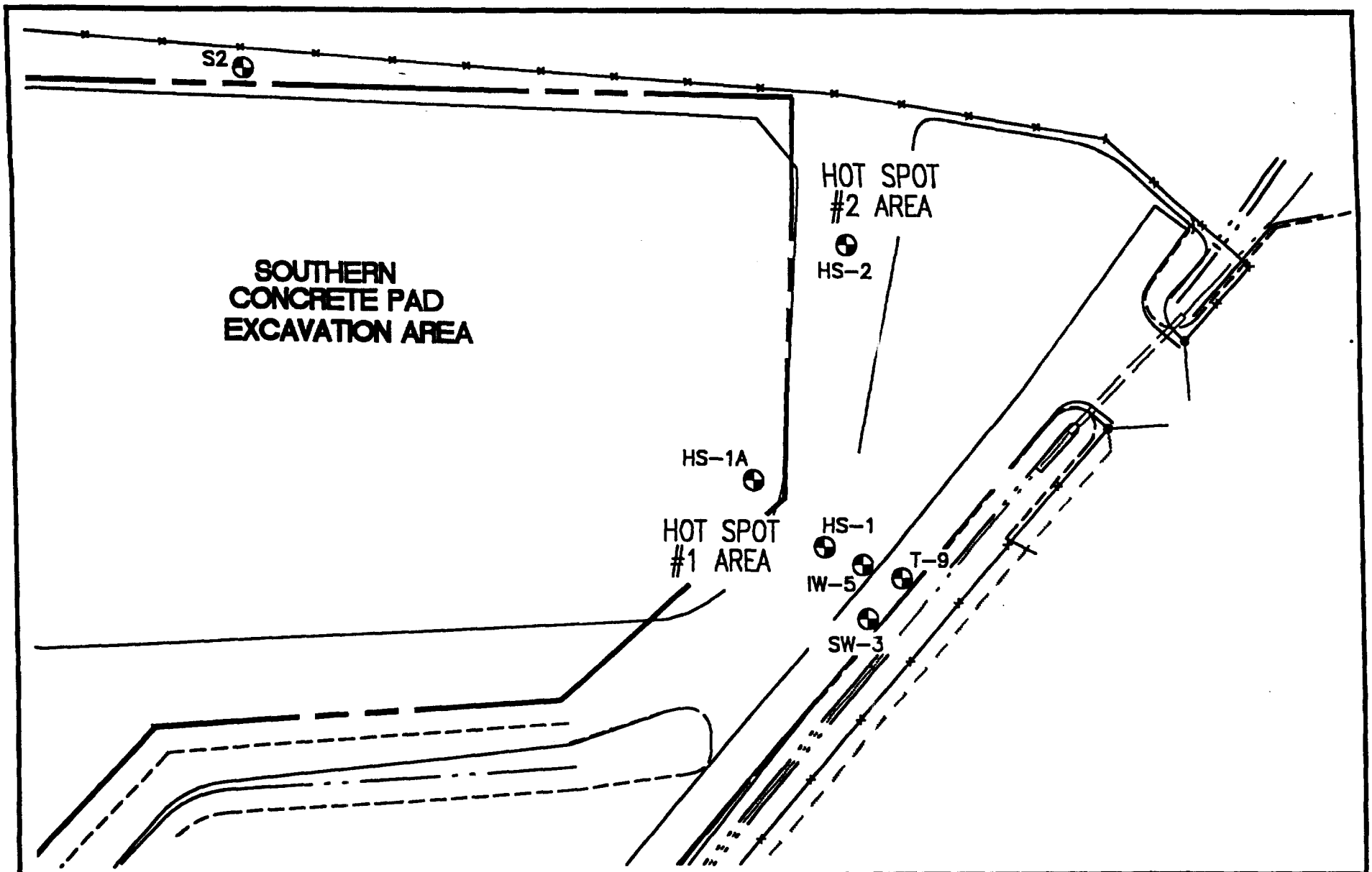
G. J. Anastos, Ph.D., P.E.
Project Manager

Attachments

cc: R Ball
N Bernstein
M Dowiak
R Hutchens

References

Freeze, R. Allen & John A. Cherry (1979), Groundwater, Prentice-Hall, Inc., Englewood Cliffs, N.J.



Verar INC.
1900 FROST ROAD, SUITE 110
BRISTOL, PA 19007
(215) 788-7844

ENVIROCHEM

FIGURE 1 – WELL LOCATION MAP

ZIONSVILLE, INDIANA

DATE:	12/03/98
DESIGNED BY:	T. WILLANS
SCALE:	NOT TO SCALE
JOB NO.:	3709.001
DWG. NO.:	9812100

Versar, Inc.

ATTACHMENTS

Versar INC.

ATTACHMENT A
Drilling Logs

Versar INC.

Log of Well HS-2 - Hot Spot #2

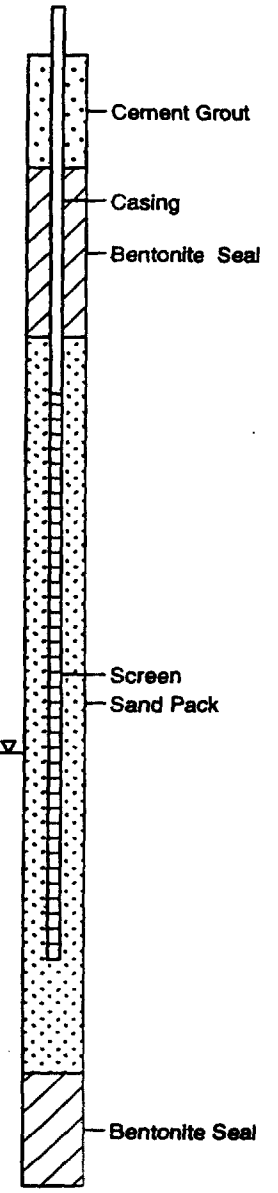
Enviro-Chem Site
Zionsville, Indiana

Date Drilled	: 10/19/98
Log By	: DVS
Drilling Company	: Earth Exploration
Driller	: Scott
Sampling Method	: Split Spoon
Drilling Method	: Auger
Screen Diameter	: 4"
Slot Size	: .20
Screen Length	: 10'
Casing Diameter	: 4"

Casing Length	: 6'
Casing Type	: PVC
Int. Water Level	: 9 (bgs)
4-Hr. Water Level	: 12.38 (bgs)

Depth in FEET	USCS	GRAPHIC	DESCRIPTION	Blow Count	PID READINGS (PPM)
0	FL		FILL: SAND, crushed stone (limestone), sand ,silt	5 4 3 4	0
2	CL-FL		CLAY FILL: Dense clay, organic-rich, brown, no odor no staining	2 3 3 4	0
4	CL-FL		CLAY FILL: Silty, some sand grains, organic plant material, slight odor	2 4 3 5	62
6	CL-FL		CLAY FILL: Silty, some fine sand, organic-rich, some discolorization, slight odor	2 2 3 2	37
8	CL		CLAY: Silt, quartz sand, organic plant material, gray-brown, slight odor, stratified and dense	1 1 2 2	81
10	CL		CLAY: Dense, gray homogenous, wet, slight staining	2 4	54
11	SM		SAND: Fine to coarse, coarsening downward,typical stream channel sequence, slight odor, slight staining	10 8	
12	GC		GRAVEL: pebbles to cobbles, rounded, quartz-rich, water bearing zone, black staining, slight odor	3 7 7 8	52
14	CL		CLAY: Silty, compressed zone with interbedded pebbles, top of sand lense, medium to coarse, slight odor	6 17 32 13	121
16	SM		SAND: Silty at top, medium to fine grained at bottom, quartz-rich, densely compacted glacial till, slight odor, no staining	27 35 32 38	4
18	MH		SILT: Densley compacted silty glacial till with sand and pebbles intermixed, no odor	27 33 5 49	2
20					

Well1: HS-2
Elev.:



12-04-1998 C:\Wv\3709\hs-3.bor

LOG OF BORING HS-2 - HOT SPOT #2

DRILL LOG HS-1A

PROJECT: ENVIRO-CHEM		OWNER: NA	SKETCH MAP:
LOCATION: ZIONSVILLE, IN		W.O. #: 2495-1010	ND - NOT DETECTED
BORING #: HS-1A	TOTAL DEPTH: 28'	DIAMETER: 8"	VPPM - VAPOR PARTS PER MILLION
SURFACE ELEV: NA	WATER LEVEL: NA	24-HRS: NA	SS - SPLIT SPOON
SCREEN DIA: 4"	LENGTH: 10'	SLOT SIZE: 0.020	F - FINE M - MEDIUM
CASING DIA: 4"	LENGTH: 17'	TYPE: PVC	C - COARSE
DRILLING CO: TOP FLIGHT	DRILLING METHOD: HSA		
DRILLER: NICK	LOG BY: VFB	DATE DRILLED: 03/16/98	NOTES:

DEPTH (FEET)	GRAPHIC LOG	WELL CONSTRUCTION	SAMPLE #	BLOW COUNT/ RQD/ %REC.	PID READING	DESCRIPTION/SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES, MOISTURE)
1						0'-7' GREY BROWN CLAY, LITTLE TO
2						TRACE SILT, TRACE F-C SAND, WET
3					50	DISTURBED, SLIGHT ODOR
4						7'-10' GREY CLAY, SOME SILT, TRACE F
5						SAND, TRACE M-C GRAVEL, DAMP, NO ODOR
6			SS-43	8-11	6	10'-10.2' BROWN M-C SAND, SATURATED,
7				12-12		NO ODOR
8			SS-44	10-11		10.2'-11.8' GREY CLAY, SOME SILT, TRACE
9				14-16		F-C SAND, DAMP, NO ODOR
10			SS-45	6-7	41	11.8'-12.4' BROWN M SAND, SATURATED,
11				8-14		NO ODOR
12			SS-46	11-12	11	12.4'-13.8' GREY CLAY, SOME SILT, TRACE
13				12-15		F SAND, DAMP, NO ODOR
14			SS-47	6-8	34	13.8'-14.4' BROWN M SAND, SATURATED,
15				12-14		SLIGHT ODOR
16			SS-48	5-4	15	14.4'-15.2' GREY & BROWN CLAY AND
17				12-12		SILT, TRACE F-C SAND/GRAVEL, DAMP
18			SS-49	10-11	15.7	15.2'-15.6' BROWN M SAND, SATURATED,
19				12-18		15.6'-17.8' GREY CLAY & SILT, TRACE
20			SS-50	9-10	3.5	F-C SAND/GRAVEL, DAMP, NO ODOR
21				10-11		17.8'-21' BROWN POORLY SORTED SAND,
22			SS-51	3-4	13	
23				7-12		21'-25' GREY CLAY, LITTLE SILT, DAMP,
24			SS-52	3-6	3	SLIGHT ODOR
25				10-10		

\T-JM\2495\W-4

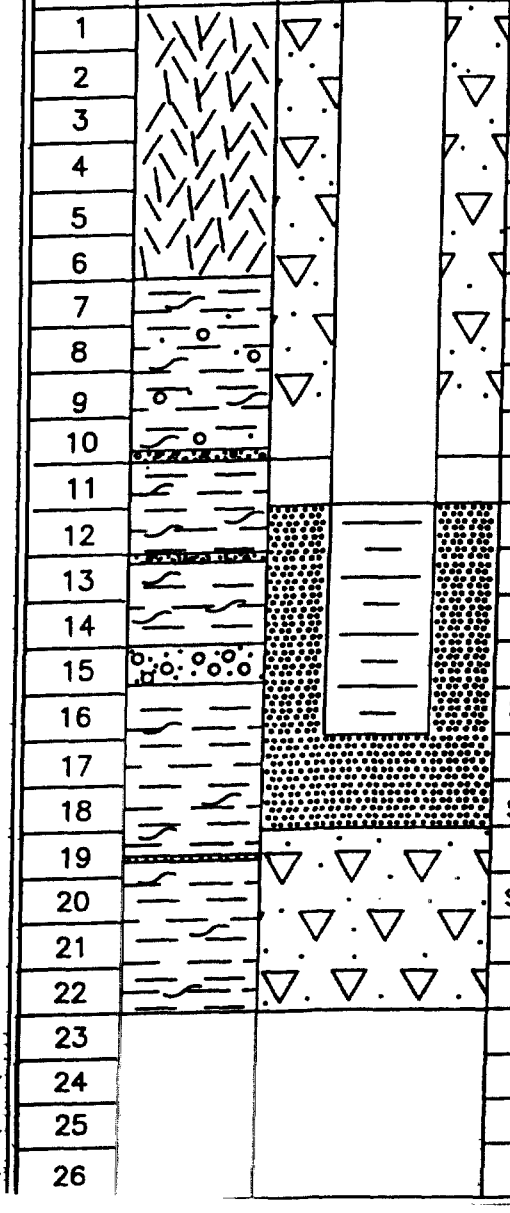
DRILL LOG HS-1A

PROJECT: ENVIRO-CHEM		OWNER: NA	SKETCH MAP:
LOCATION: ZIONSVILLE, IN		W.O. #: 2495-1010	ND - NOT DETECTED
BORING #: HS-1A	TOTAL DEPTH: 28'	DIAMETER: 8"	VPPM - VAPOR PARTS PER MILLION
SURFACE ELEV: NA	WATER LEVEL: NA	24-HRS: NA	SS - SPLIT SPOON
SCREEN DIA: 4"	LENGTH: 10'	SLOT SIZE: 0.020	F - FINE M - MEDIUM
CASING DIA: 4"	LENGTH: 17'	TYPE: PVC	C - COARSE
DRILLING CO: TOP FLIGHT		DRILLING METHOD: HSA	
DRILLER: NICK	LOG BY: VFB	DATE DRILLED: 03/16/98	NOTES:

DEPTH (FEET)	GRAPHIC LOG	WELL CONSTRUCTION	SAMPLE #	BLOW COUNT/ RQD/ %REC.	PID READING	DESCRIPTION/SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES, MOISTURE)
26			SS-53	6-13	1	25'-25.3' BROWN SAND, SATURATED,
27				15-21		NO ODOR
28						25.3'-27' GREY CLAY, LITTLE SILT, NO
29						ODOR, DAMP
30						27'-27.3' BROWN SAND, SATURATED, NO
						ODOR
						27.3'-28' GREY CLAY, LITTLE SILT, DAMP,
						NO ODOR

DRILL LOG HS-1

PROJECT: ENVIRO-CHEM		OWNER: NA	SKETCH MAP:
LOCATION: ZIONSVILLE, IN		W.O. #: 2495-1010	ND - NOT DETECTED
BORING #: HS-1	TOTAL DEPTH: 22'	DIAMETER: 8"	VPPM - VAPOR PARTS PER MILLION
SURFACE ELEV: NA	WATER LEVEL: NA	24-HRS: NA	SS - SPLIT SPOON
SCREEN DIA: 4"	LENGTH: 5'	SLOT SIZE: 0.020	F - FINE M - MEDIUM
CASING DIA: 4"	LENGTH: 11'	TYPE: PVC	C - COARSE
DRILLING CO: TOP FLIGHT	DRILLING METHOD: HSA		
DRILLER: NICK	LOG BY: VFB	DATE DRILLED: 03/12/98	NOTES:



DEPTH (FEET)	SAMPLE #	BLOW COUNT/ RQD/ %REC.	PID READING	DESCRIPTION/SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES, MOISTURE)
1				
2				0'--6' GREY AND BROWN CLAY, LITTLE
3			80	SILT, TRACE F-C SAND, WET, DISTURBED
4				PESTICIDE ODOR
5				
6	SS-18	8-15	54	6'--9.8' GREY CLAY, SOME SILT, TRACE
7		17-32		F-M SAND, TRACE F-M GRAVEL (WELL
8	SS-19	9-10	12.5	ROUNDED), DAMP, MOTTLED, SLIGHT ODOR
9		13-22		SORTED, SATURATED, NO ODOR
10	SS-20	5-5	20.4	9.8'-10' BROWN F-M GRAVEL, SATURATED,
11		17-12		SLIGHT ODOR (CHLORINATED SOLVENT)
12	SS-21	3-5	3.0	10'-12' GREY CLAY, SOME SILT, MOIST,
13		8-9		NO ODOR
14	SS-22	6-8	114.7	12'-12.2' BROWN F-M SAND & GRAVEL,
15		11-12		SATURATED, ODOR (CHLORINATED SOLVENT)
16	SS-23	3-4	ND	12.2'-14' GREY CLAY, LITTLE SILT, DAMP,
17		7-10		NO ODOR
18	SS-24	4-5	ND	14'-14.8' BROWN C SAND, STRONG ODOR
19		7-9		(CHLORINATED SOLVENTS)
20	SS-25	4-6	ND	14.8'-19.5' GREY CLAY, LITTLE SILT,
21		9-9		DAMP, NO ODOR
22				19.5'-19.6' BROWN F SAND, SATURATED,
23				NO ODOR
24				19.6'-22' GREY CLAY, TRACE SILT, DAMP,
25				NO ODOR
26				

:\TJW\2459\W-1

Versar INC.

ATTACHMENT B
Water Level Field Data

HS-2 Pumping Test Test Site: Enviro-Chem Location: Zionsville, Indiana Depth-to-water: 12.410'			Well HS-2 Readings Test Conducted on: 11-09-98 Test Conducted by: TK & TJW	
Reading	Pump test duration [min.]	Water level [ft]	Change in Water Level [ft]	Comments:
Pre-test	0.0000	12.410	0.000	
1	0.0000	12.856	-0.446	
2	0.0166	12.847	-0.437	
3	0.0333	12.850	-0.440	
4	0.0500	12.850	-0.440	
5	0.0666	12.850	-0.440	
6	0.0833	12.847	-0.437	
7	0.1666	12.875	-0.465	
8	0.2500	12.894	-0.484	
9	0.3333	12.894	-0.484	
10	0.4166	12.913	-0.503	
11	0.5000	12.961	-0.551	
12	0.5833	13.065	-0.655	
13	0.6666	13.056	-0.646	
14	0.7500	13.037	-0.627	
15	0.8333	13.037	-0.627	
16	0.9166	13.037	-0.627	
17	1	13.103	-0.693	
18	2	13.503	-1.093	
19	3	13.683	-1.273	
20	4	13.759	-1.349	
21	5	13.826	-1.416	
22	6	13.883	-1.473	
23	7	13.930	-1.520	
24	8	13.959	-1.549	
25	9	13.987	-1.577	
26	10	14.006	-1.596	
27	20	14.120	-1.710	
28	30	13.189	-0.779	
29	40	13.360	-0.950	
30	50	12.980	-0.570	
31	60	12.210	0.200	
32	70	12.961	-0.551	
33	80	12.676	-0.266	
34	90	12.619	-0.209	
35	100	12.609	-0.199	
36	200	13.122	-0.712	
37	300	13.141	-0.731	
38	400	13.141	-0.731	
39	500	13.113	-0.703	
40	600	13.084	-0.674	
41	700	13.046	-0.636	
42	800	13.037	-0.627	
43	900	13.037	-0.627	
44	1,000	12.305	0.105	
45	1,200	12.153	0.257	
46	1,400	12.371	0.039	
47	1,600	12.486	-0.076	
48	1,800	12.562	-0.152	
49	2,000	12.600	-0.190	
50	2,200	12.657	-0.247	

HS-2 Pumping Test Test Site: Enviro-Chem Location: Zionsville, Indiana Depth-to-water: 12.410'			Well HS-2 Readings Test Conducted on: 11-09-98 Test Conducted by: TK & TJW	
Reading	Pump test duration [min.]	Water level [ft]	Change in Water Level [ft]	Comments:
51	2,400	12.685	-0.275	
52	2,600	12.723	-0.313	
53	2,800	13.170	-0.760	
54	3,000	13.208	-0.798	
55	3,200	13.236	-0.826	
56	3,400	13.265	-0.855	
57	3,600	13.293	-0.883	
58	3,800	13.322	-0.912	
59	4,000	13.331	-0.921	
60	4,200	13.331	-0.921	
61	4,400	13.341	-0.931	
62	4,600	13.360	-0.950	
63	4,800	13.379	-0.969	
64	5,000	13.398	-0.988	
65	5,200	13.408	-0.998	
66	5,400	13.398	-0.988	
67	5,600	13.274	-0.864	
68	5,800	13.274	-0.864	
69	6,000	13.303	-0.893	
70	6,200	13.322	-0.912	
71	6,400	13.322	-0.912	
72	6,600	13.331	-0.921	
73	6,800	13.350	-0.940	
74	7,000	13.332	-0.922	
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HS-2 Pumping Test Test Site: Enviro-Chem Location: Zionsville, Indiana Depth-to-water: 7.245'			Well HS-1 Readings Test Conducted on: 11-09-98 Test Conducted by: TK & TJW	
Reading	Pump test duration [min.]	Water level [ft]	Change in Water Level [ft]	Comments:
1	0.0000	7.245	0.000	
2	0.0166	7.235	0.010	
3	0.0333	7.245	0.000	
4	0.0500	7.235	0.010	
5	0.0666	7.235	0.010	
6	0.0833	7.235	0.010	
7	0.1666	7.235	0.010	
8	0.2500	7.245	0.000	
9	0.3333	7.235	0.010	
10	0.4166	7.245	0.000	
11	0.5000	7.245	0.000	
12	0.5833	7.245	0.000	
13	0.6666	7.245	0.000	
14	0.7500	7.245	0.000	
15	0.8333	7.245	0.000	
16	0.9166	7.245	0.000	
17	1	7.245	0.000	
18	2	7.245	0.000	
19	3	7.245	0.000	
20	4	7.245	0.000	
21	5	7.245	0.000	
22	6	7.245	0.000	
23	7	7.245	0.000	
24	8	7.245	0.000	
25	9	7.245	0.000	
26	10	7.245	0.000	
27	20	7.245	0.000	
28	30	7.245	0.000	
29	40	7.245	0.000	
30	50	7.245	0.000	
31	60	7.245	0.000	
32	70	7.245	0.000	
33	80	7.245	0.000	
34	90	7.245	0.000	
35	100	7.245	0.000	
36	200	7.226	0.019	
37	300	7.207	0.038	
38	400	7.170	0.075	
39	500	7.086	0.159	
40	600	6.889	0.356	
41	700	6.693	0.552	
42	800	6.533	0.712	
43	900	6.543	0.702	
44	1,000	6.939	0.306	
45	1,200	6.898	0.347	
46	1,400	6.833	0.412	
47	1,600	6.647	0.598	
48	1,800	6.824	0.421	
49	2,000	6.936	0.309	
50	2,200	7.001	0.244	

HS-2 Pumping Test Test Site: Enviro-Chem Location: Zionsville, Indiana Depth-to-water: 7.245'			Well HS-1 Readings Test Conducted on: 11-09-98 Test Conducted by: TK & TJW	
Reading	Pump test duration [min.]	Water level [ft]	Change in Water Level [ft]	Comments:
51	2,400	7.048	0.197	
52	2,600	7.086	0.159	
53	2,800	7.104	0.141	
54	3,000	7.142	0.103	
55	3,200	7.151	0.094	
56	3,400	7.170	0.075	
57	3,600	7.188	0.057	
58	3,800	7.217	0.028	
59	4,000	7.235	0.010	
60	4,200	7.226	0.019	
61	4,400	7.226	0.019	
62	4,600	7.245	0.000	
63	4,800	7.245	0.000	
64	5,000	7.245	0.000	
65	5,200	7.254	-0.009	
66	5,400	7.254	-0.009	
67	5,600	7.245	0.000	
68	5,800	7.245	0.000	
69	6,000	7.235	0.010	
70	6,200	7.226	0.019	
71	6,400	7.217	0.028	
72	6,600	7.207	0.038	
73	6,800	7.198	0.047	
74	7,000	7.170	0.075	
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HS-2 Pumping Test
Test Site: Enviro-Chem
Location: Zionsville, Indiana
Depth-to-water: 8.410'

Well HS-1A Readings
Test Conducted on: 11-09-98
Test Conducted by: TK & TJW

Reading	Pump test duration [min.]	Water level [ft]	Change in Water Level [ft]	Comments:
1	0	8.410	0.000	
2	240	8.300	0.110	
3	360	8.330	0.080	
4	720	8.140	0.270	
5	1080	8.040	0.370	
6	1200	8.110	0.300	
7	2400	8.600	-0.190	
8	2520	8.620	-0.210	
9	2640	8.640	-0.230	
10	2760	8.640	-0.230	
11	2880	8.640	-0.230	
12	3120	8.640	-0.230	
13	3360	8.640	-0.230	
14	3600	8.640	-0.230	
15	3840	8.640	-0.230	
16	4080	8.700	-0.290	
17	4320	8.700	-0.290	
18	4560	8.730	-0.320	
19	4800	8.730	-0.320	
20	5040	8.730	-0.320	
21	5280	8.730	-0.320	
22	5520	8.730	-0.320	
23	6000	8.730	-0.320	
24	6360	8.730	-0.320	
25	6720	8.730	-0.320	
26	7000			
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HS-2 Pumping Test Test Site: Enviro-Chem Location: Zionsville, Indiana Depth-to-water: 9.740'			Well S-2 Readings Test Conducted on: 11-09-98 Test Conducted by: TK & TJW	
Reading	Pump test duration [min.]	Water level [ft]	Change in Water Level [ft]	Comments:
1	0	9.740	0.000	
2	1200	9.420	0.320	
3	1920	9.540	0.200	
4	2280	9.720	0.020	
5	2400	9.800	-0.060	
6	2520	9.710	0.030	
7	2640	9.710	0.030	
8	2760	9.720	0.020	
9	2880	9.720	0.020	
10	3120	9.720	0.020	
11	3360	9.720	0.020	
12	3600	9.720	0.020	
13	3840	9.720	0.020	
14	4080	9.730	0.010	
15	4320	9.730	0.010	
16	4560	9.730	0.010	
17	4800	9.730	0.010	
18	5040	9.730	0.010	
19	5280	9.730	0.010	
20	5520	9.730	0.010	
21	6000	9.730	0.010	
22	6360	9.730	0.010	
23	6720	9.730	0.010	
24	7000	9.730	0.010	
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HS-2 Pumping Test Test Site: Enviro-Chem Location: Zionsville, Indiana Depth-to-water: 4.400'			Well S-3 Readings Test Conducted on: 11-09-98 Test Conducted by: TK & TJW	
Reading	Pump test duration [min.]	Water level [ft]	Change in Water Level [ft]	Comments:
1	0	4.400	0.000	
2	60	4.340	0.060	
3	360	4.310	0.090	
4	390	4.240	0.160	
5	420	4.140	0.260	
6	450	4.140	0.260	
7	480	4.140	0.260	
8	540	4.140	0.260	
9	600	4.140	0.260	
10	660	4.140	0.260	
11	720	4.140	0.260	
12	840	4.140	0.260	
13	960	4.140	0.260	
14	1080	4.140	0.260	
15	1200	4.140	0.260	
16	1320	4.140	0.260	
17	1440	4.140	0.260	
18	1560	4.140	0.260	
19	1680	4.140	0.260	
20	1800	4.140	0.260	
21	1920	4.200	0.200	
22	2400	4.320	0.080	
23	2520	4.320	0.080	
24	2640	4.320	0.080	
25	2760	4.320	0.080	
26	2880	4.320	0.080	
27	3120	4.320	0.080	
28	3360	4.320	0.080	
29	3600	4.320	0.080	
30	3840	4.420	-0.020	
31	4080	4.420	-0.020	
32	4320	4.420	-0.020	
33	4560	4.420	-0.020	
34	4800	4.420	-0.020	
35	5040	4.420	-0.020	
36	5280	4.420	-0.020	
37	5520	4.420	-0.020	
38	6000	4.420	-0.020	
39	6360	4.420	-0.020	
40	6720	4.420	-0.020	
41	7000	4.420	-0.020	
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HS-2 Pumping Test Test Site: Enviro-Chem Location: Zionsville, Indiana Depth-to-water: 2.900'			Well T-9 Readings Test Conducted on: 11-09-98 Test Conducted by: TK & TJW	
Reading	Pump test duration [min.]	Water level [ft]	Change in Water Level [ft]	Comments:
1	0	2.900	0.000	
2	15	2.720	0.180	
3	75	2.830	0.070	
4	420	2.710	0.190	
5	450	2.630	0.270	
6	1080	2.300	0.600	
7	1320	2.320	0.580	
8	1920	2.700	0.200	
9	2280	2.730	0.170	
10	2400	2.810	0.090	
11	2520	2.840	0.060	
12	2640	2.910	-0.010	
13	2760	2.900	0.000	
14	4080	2.920	-0.020	
15	4320	2.930	-0.030	
16	4560	2.930	-0.030	
17	4800	2.930	-0.030	
18	5040	2.930	-0.030	
19	5280	2.930	-0.030	
20	5520	2.930	-0.030	
21	6000	2.930	-0.030	
22	6360	2.930	-0.030	
23	6720	2.930	-0.030	
24	7000	2.930		
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HS-2 Pumping Test
Test Site: Enviro-Chem
Location: Zionsville, Indiana
Depth-to-water: 4.510'

Well IW-5 Readings
Test Conducted on: 11-09-98
Test Conducted by: TK & TJW

Reading	Pump test duration [min.]	Water level [ft]	Change in Water Level [ft]	Comments:
1	0	4.510	0.000	
2	210	4.230	0.280	
3	225	4.230	0.280	
4	240	4.230	0.280	
5	270	4.230	0.280	
6	300	4.230	0.280	
7	330	4.230	0.280	
8	360	4.100	0.410	
9	1080	4.000	0.510	
10	1920	4.230	0.280	
11	2400	4.440	0.070	
12	2520	4.510	0.000	
13	2640	4.510	0.000	
14	2760	4.510	0.000	
15	2880	4.510	0.000	
16	3120	4.510	0.000	
17	3360	4.510	0.000	
18	3600	4.510	0.000	
19	3840	4.600	-0.090	
20	4080	4.620	-0.110	
21	5040	4.620	-0.110	
22	5280	4.620	-0.110	
23	5520	4.620	-0.110	
24	6000	4.620	-0.110	
25	6360	4.620	-0.110	
26	6720	4.620	-0.110	
27	7000	4.620		
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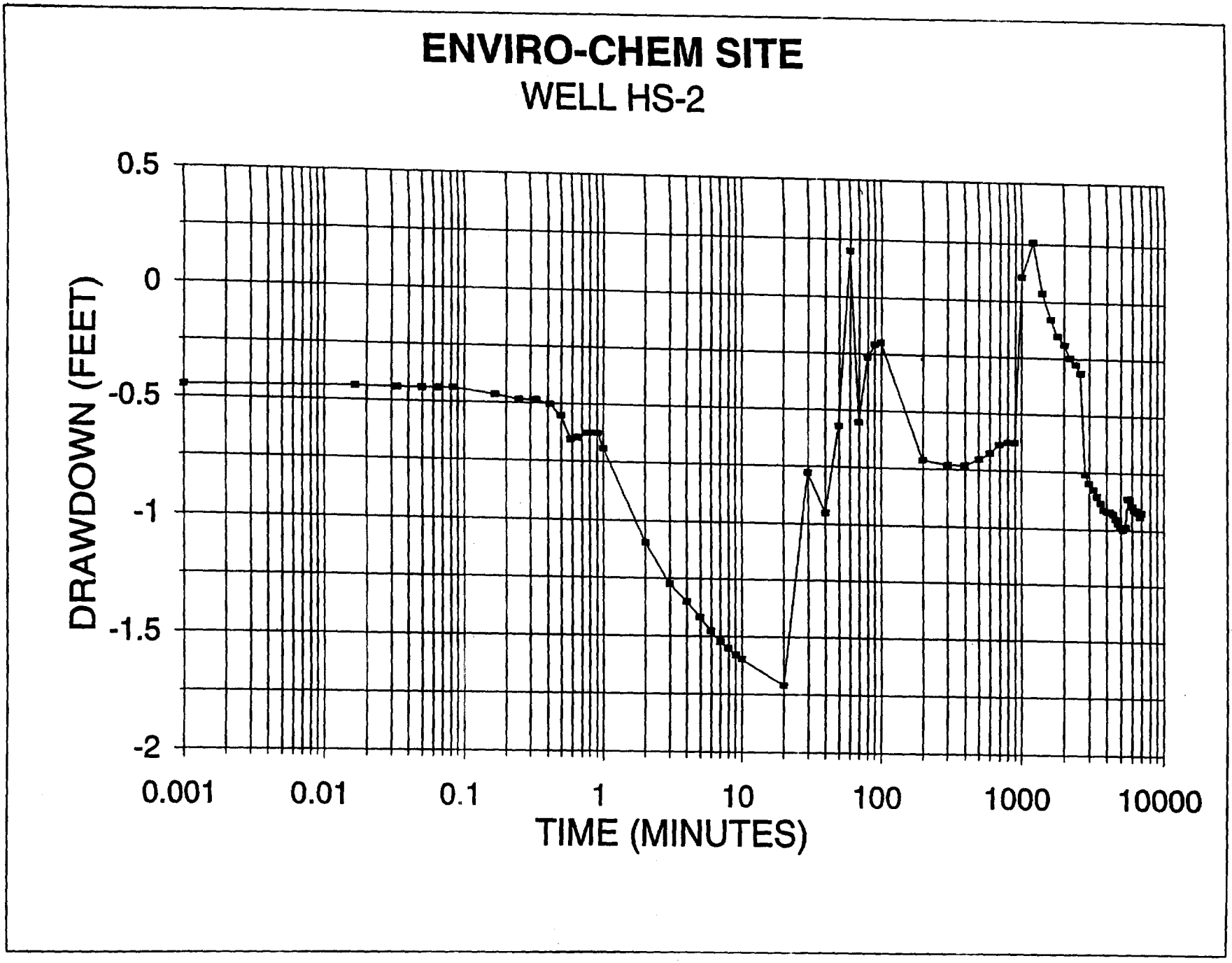
Versar INC.

ATTACHMENT C
Drawdown Versus Time Plots


ENVIRO-CHEM SITE
WELL HS-2
DRAWDOWN (FEET)
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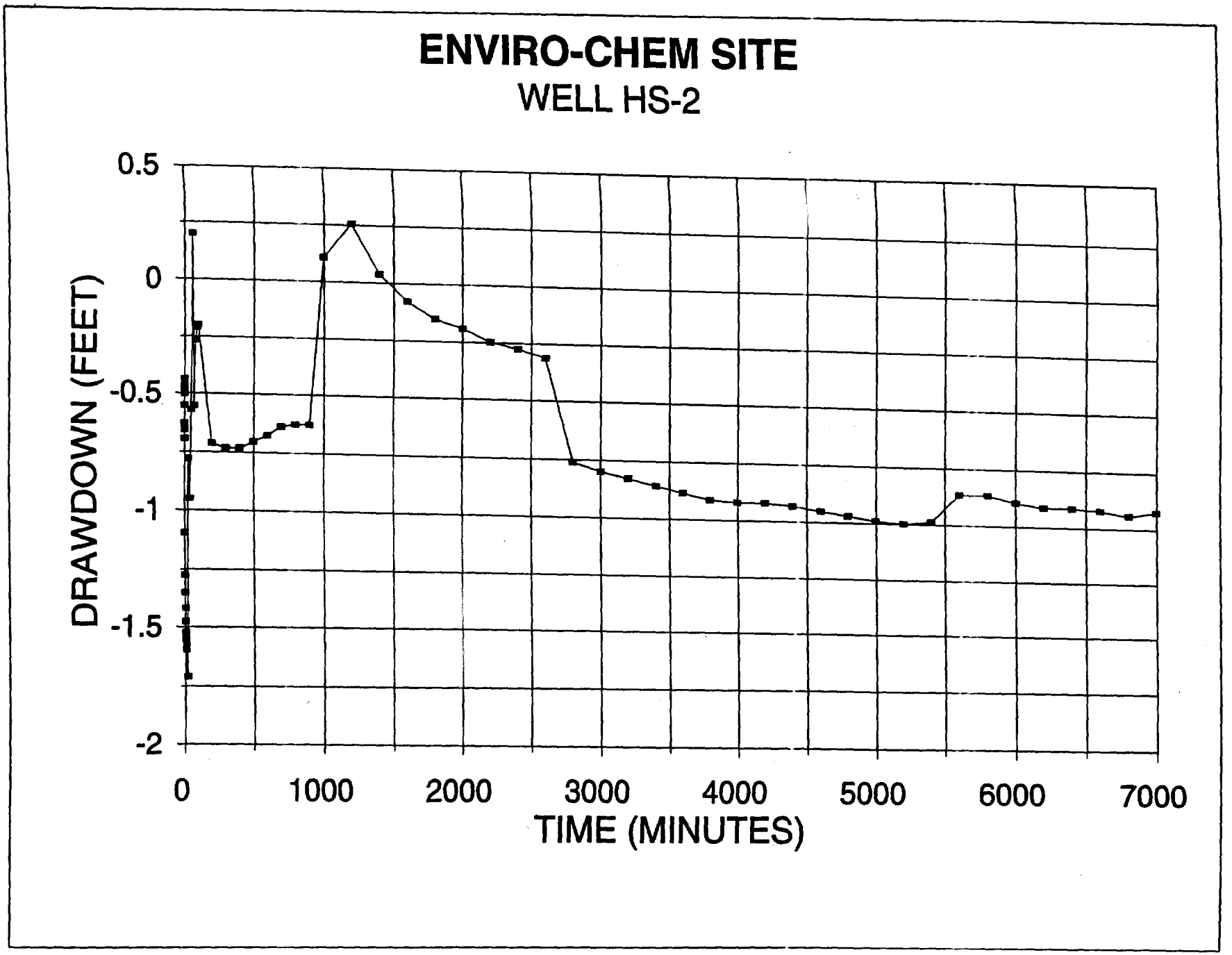
TIME (MINUTES)


ENVIRO-CHEM SITE
WELL HS-2
DRAWDOWN (FEET)
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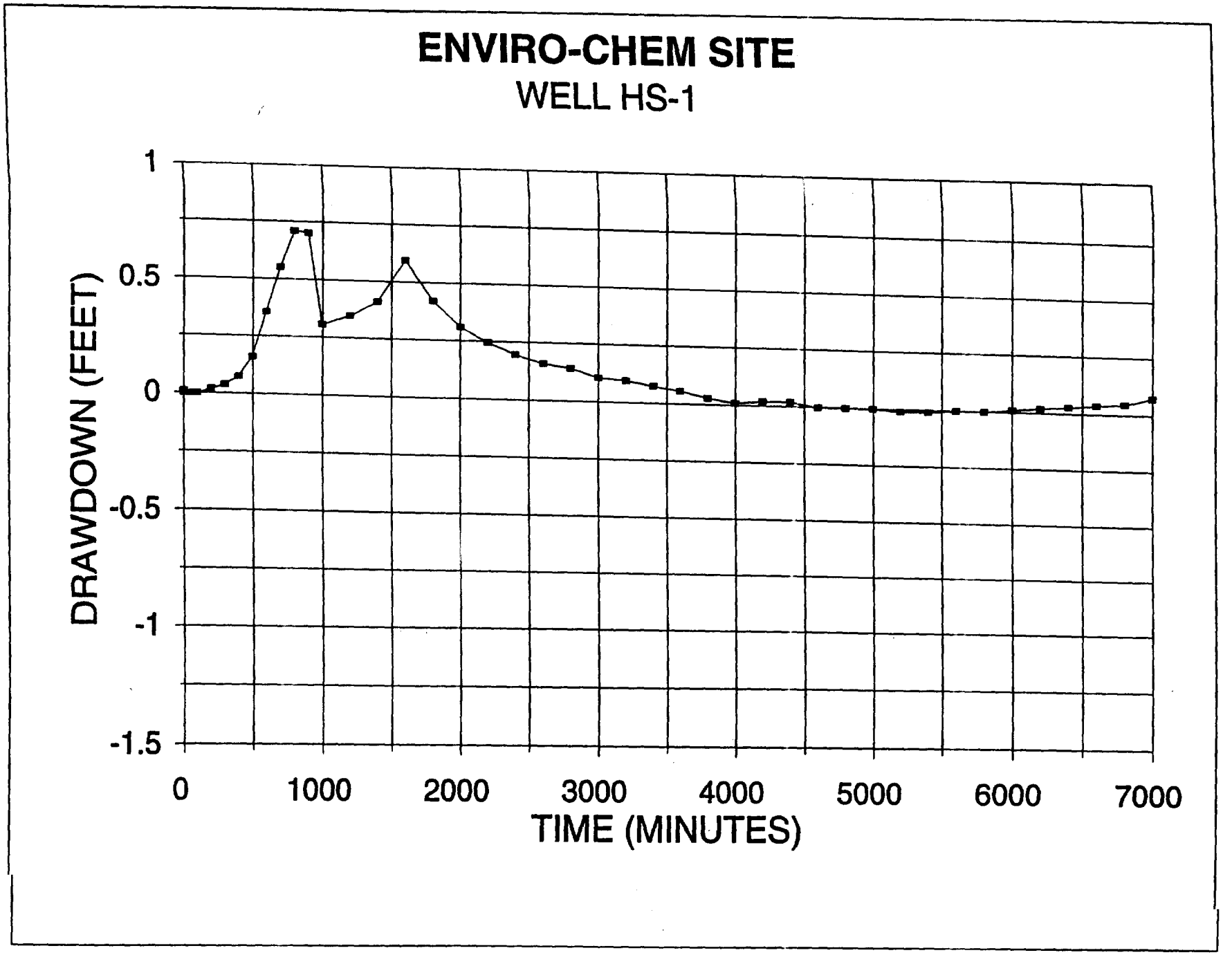
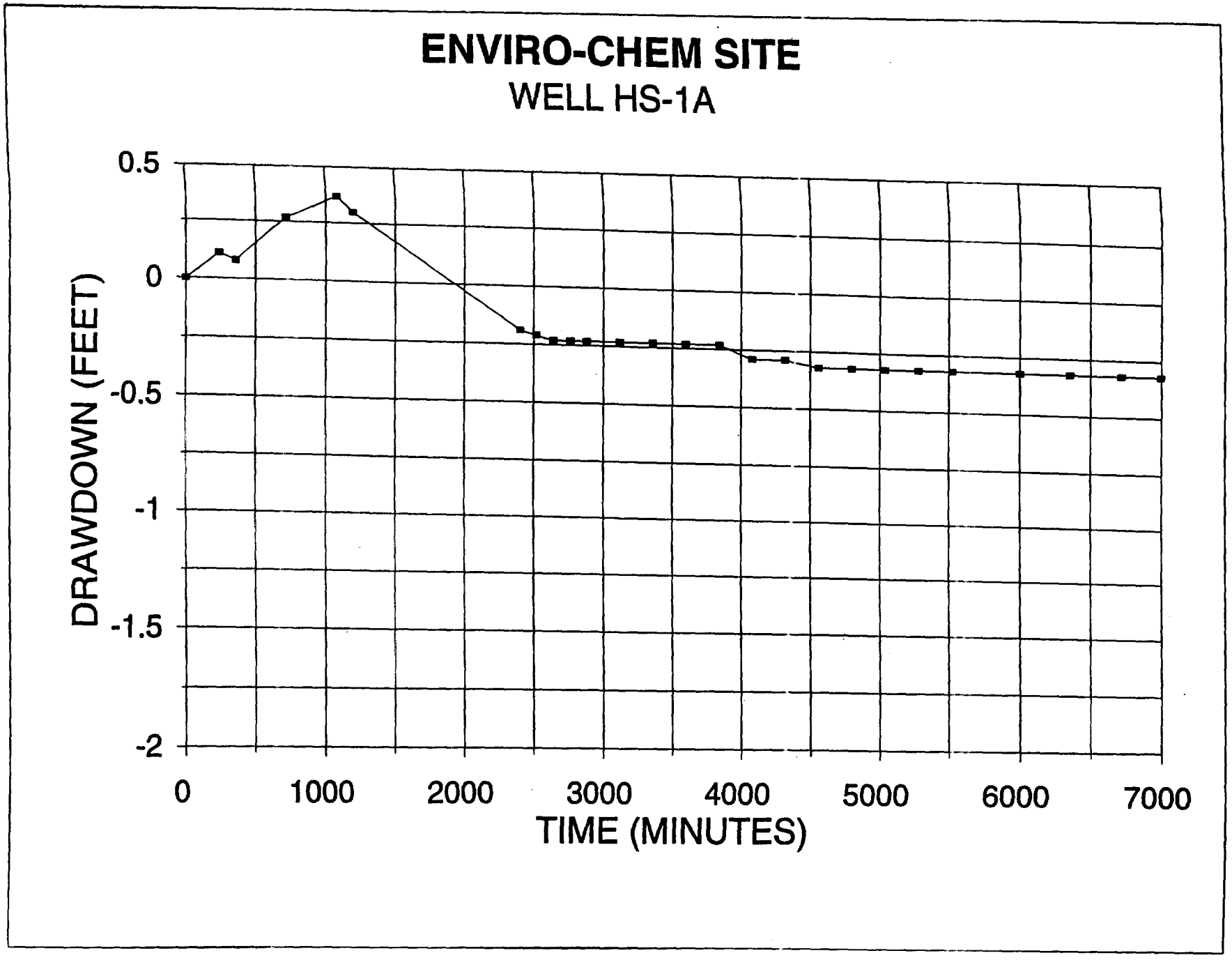
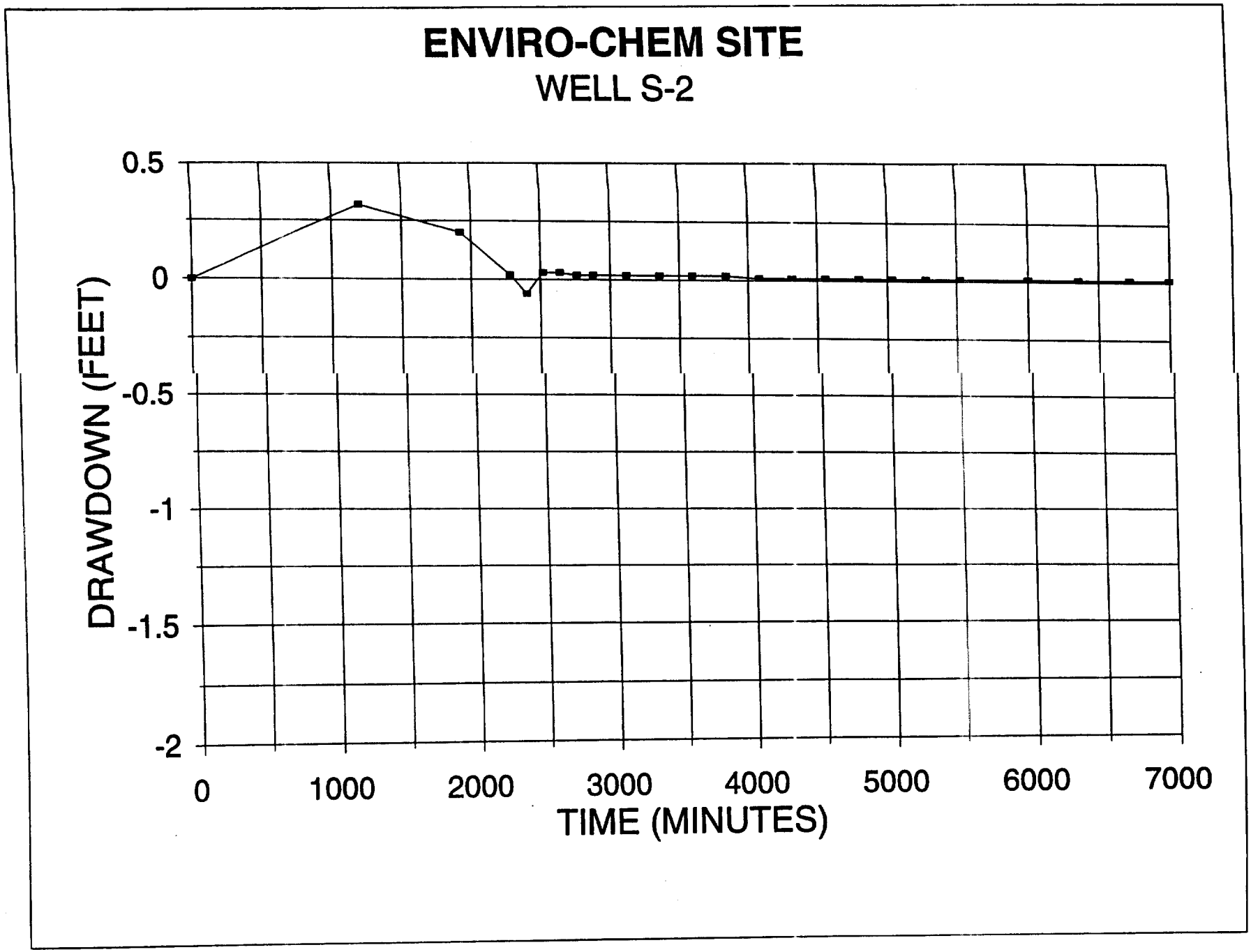
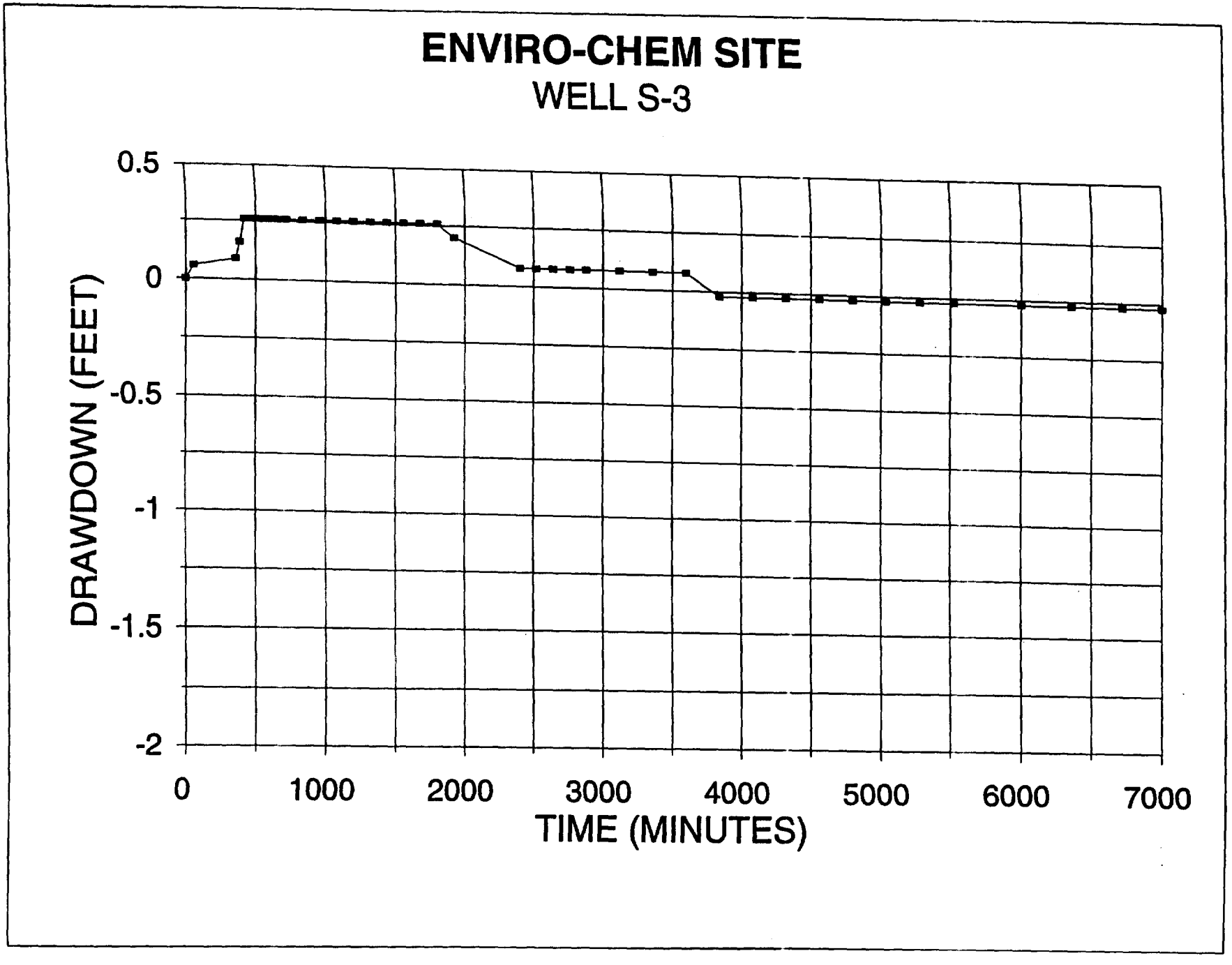
6000
7000
TIME (MINUTES)


ENVIRO-CHEM SITE
WELL HS-1
DRAWDOWN (FEET)
1
0.5
0
-0.5
-1
-1.5
0
1000
2000
3000
4000
5000
6000
7000
TIME (MINUTES)

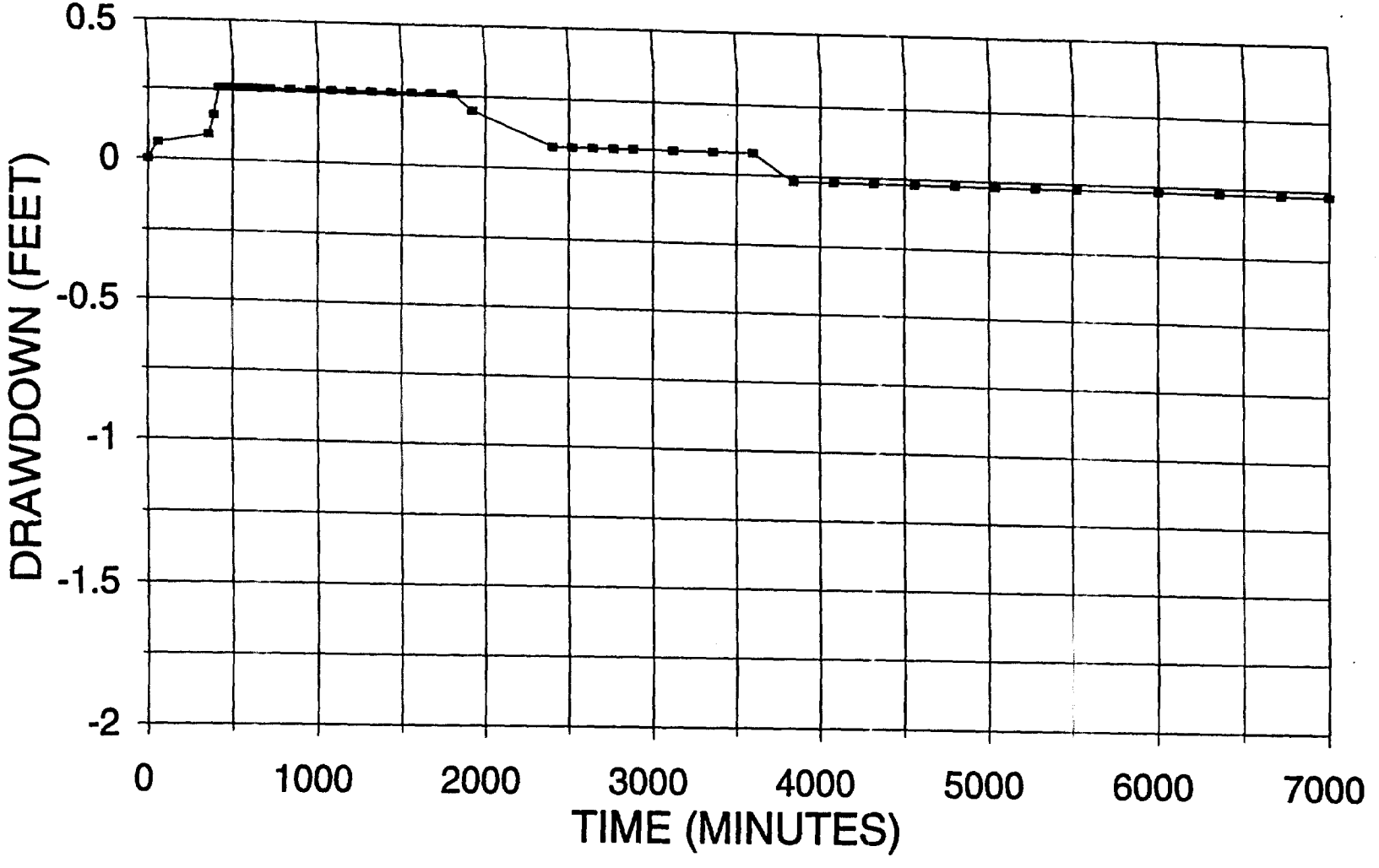

ENVIRO-CHEM SITE
WELL HS-1A
DRAWDOWN (FEET)
0.5
0
-0.5
-1
-1.5
-2
0
1000
2000
3000
4000
5000
6000
7000
TIME (MINUTES)

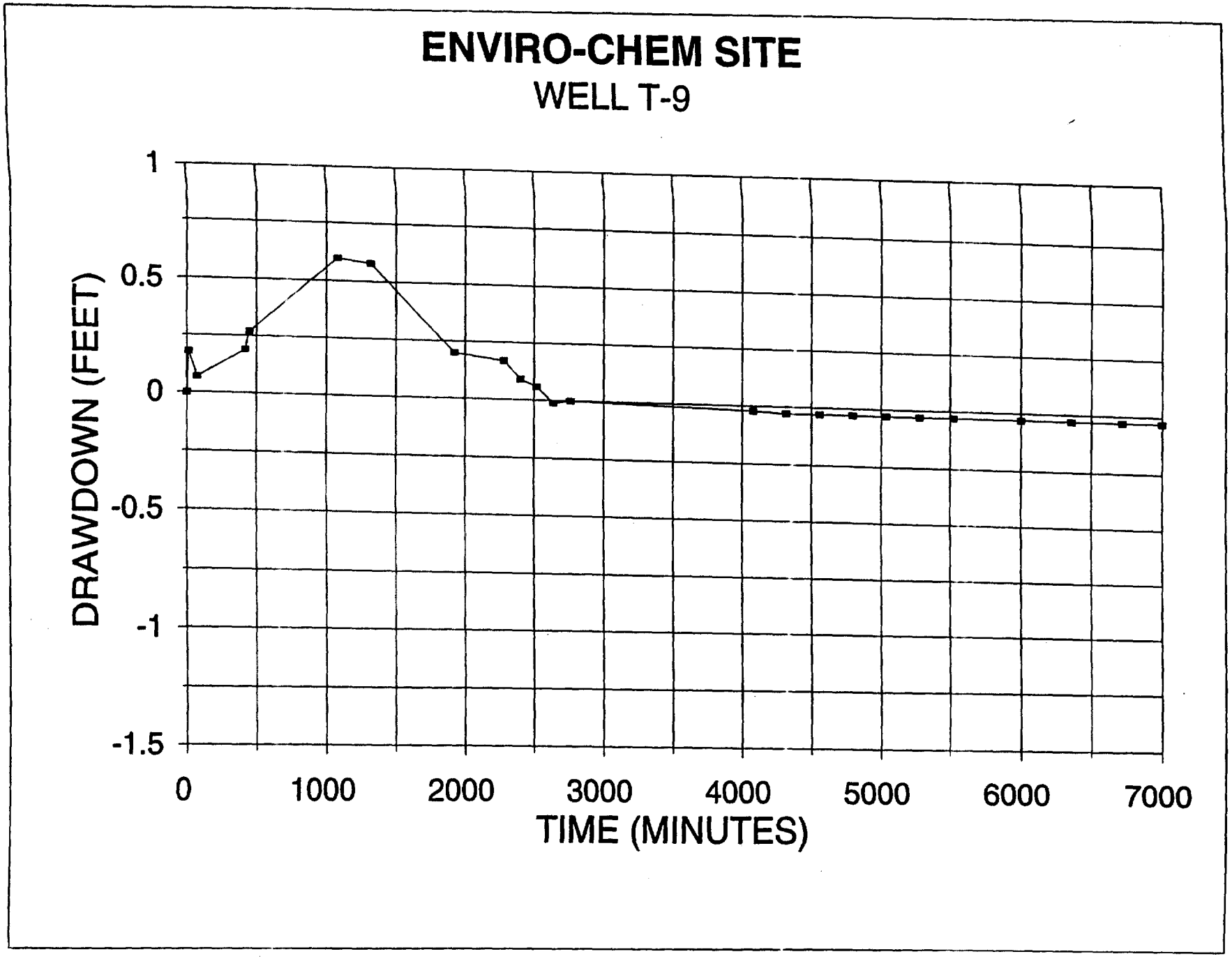

ENVIRO-CHEM SITE
WELL S-2
DRAWDOWN (FEET)
0.5
0
-0.5
-1
-1.5
-2
0
1000
2000
3000
4000
5000
6000
7000
TIME (MINUTES)

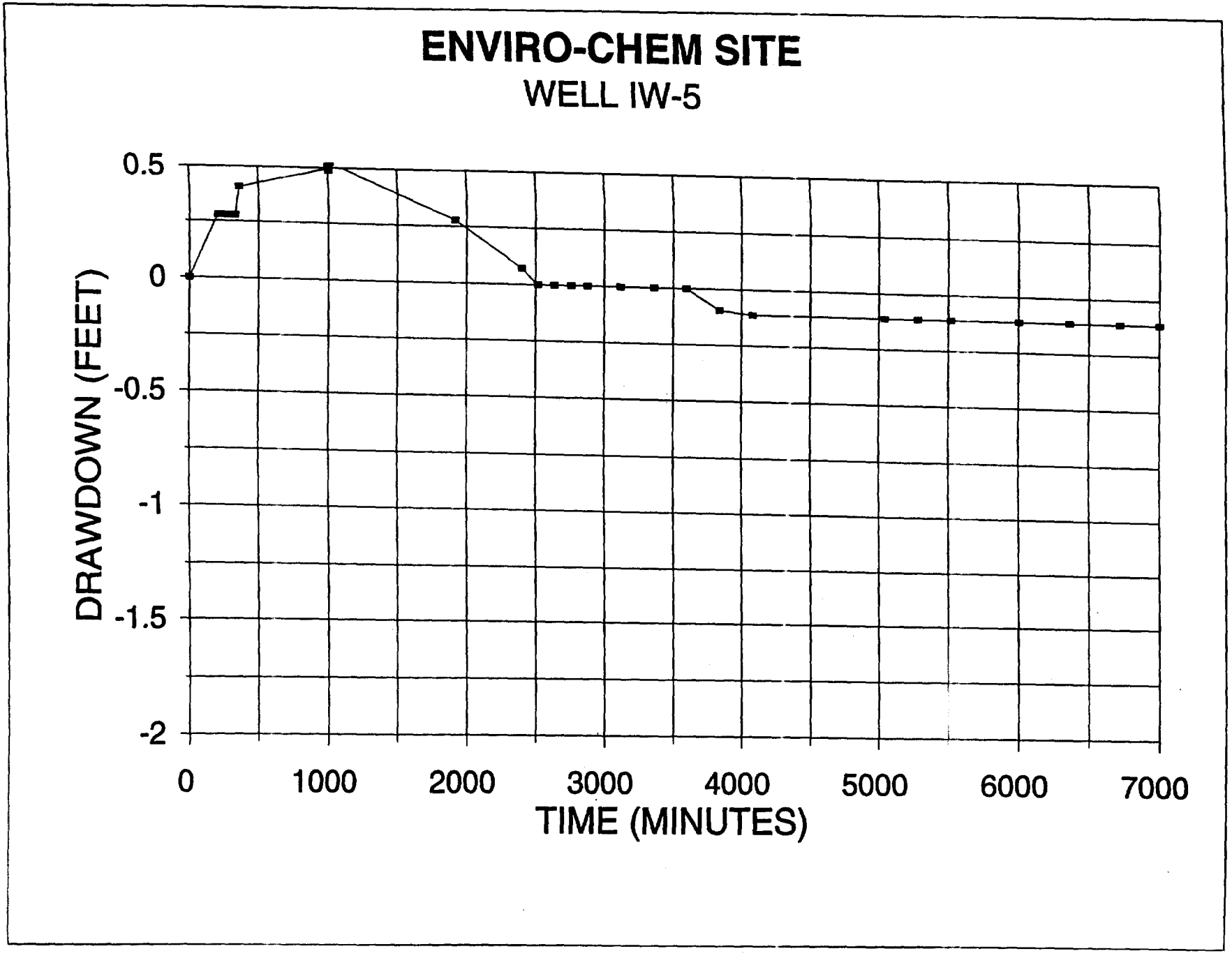

ENVIRO-CHEM SITE
WELL S-3
DRAWDOWN (FEET)
0.5
0
-0.5
-1
-1.5
-2
0
1000
2000
3000
4000
5000
6000
7000
TIME (MINUTES)

ENVIRO-CHEM SITE

WELL S-3




ENVIRO-CHEM SITE
WELL T-9
DRAWDOWN (FEET)
1
0.5
0
-0.5
-1
-1.5
0
1000
2000
3000
4000
5000
6000
7000
TIME (MINUTES)


ENVIRO-CHEM SITE
WELL IW-5
DRAWDOWN (FEET)
0.5
0
-0.5
-1
-1.5
-2
0
1000
2000
3000
4000
5000
6000
7000
TIME (MINUTES)

Versar INC.

ATTACHMENT D
Hydraulic Conductivity Calculations

DATA SET: HS-2

CLIENT: Enviro-Chem Site
LOCATION: Zionsville, Indiana
COUNTY: Clinton
PROJECT: Well Pump Test Data
AQUIFER: Endless
TAKE RADIUS: 0.416 ft
SCREEN TOP: 6.000 ft
NITIAL HEAD: 1.159 ft

DATE: 09-NOV-98
WELL NO.: HS-2
WELL DEPTH: 18.00 ft
WATER TABLE: 12.410 ft
THICKNESS: 5.59 ft
CASING RADIUS: 0.167 ft
SCREEN BASE: 16.00 ft
TRANS. RATIO: 1.0000

MODEL PARAMETERS:

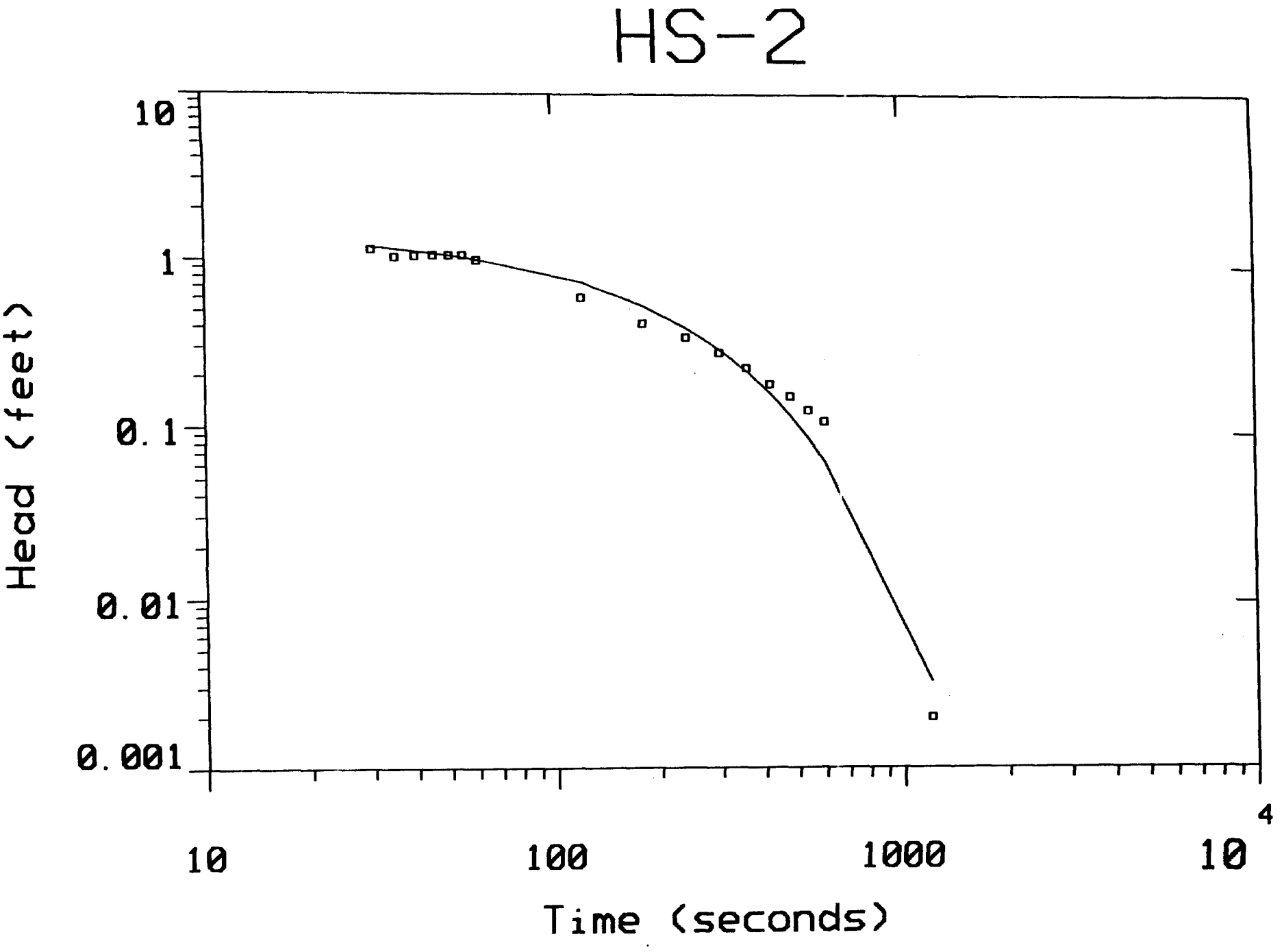
TRANSMISSIVITY: 6.55E-5 square ft/sec

CONDUCTIVITY: 1.17E-5 ft/sec

MODEL TYPE: UNCONFINED PARTIALLY PENETRATED AQUIFER (Bouwer & Rice)

No.	TIME (secs)	Head, H (ft) DATA	SYNTHETIC	DIFFERENCE (percent)
1	30.00	1.15	1.27	-10.13
2	35.00	1.05	1.24	-17.73
3	40.00	1.06	1.20	-13.58
4	45.00	1.08	1.17	-8.58
5	50.00	1.08	1.14	-5.65
6	55.00	1.08	1.11	-2.80
7	60.00	1.01	1.08	-6.52
8	120.0	0.617	0.780	-26.48
9	180.0	0.437	0.562	-28.64
10	240.0	0.361	0.404	-12.17
11	300.0	0.294	0.291	0.780
12	360.0	0.237	0.210	11.33
13	420.0	0.190	0.151	20.33
14	480.0	0.161	0.109	32.27
15	540.0	0.133	0.0785	40.94
16	600.0	0.114	0.0565	50.37
17	1200.0	0.00100	0.00213	-112.8

CURRENT RESOLUTION MATRIIX NOT AVAILABLE


HS-2
10
1
0.1
0.01
0.001
Head (feet)
10
100
1000
10
4
Time (seconds)

Versar INC.

ATTACHMENT E
Laboratory Analytical Results

NATIONAL ENVIRONMENTAL TESTING, INC.

Indianapolis Division
6964 Hillsdale Ct.
Indianapolis, IN 46250
Tel: (317) 842-4261
Fax: (317) 842-4286

ANALYTICAL REPORT

Mr. Greg Scarpone
HANDEX OF INDIANA
8579 Zionsville Rd.
Indianapolis, IN 46268

11/19/1998

NET Job Number: 98.07787

Enclosed are the Analytical Results for the following samples submitted to NET, Inc. Indianapolis Division for analysis:

Project Description: ENVIROCHEM

Sample Number	Sample Description	Date Taken	Date Received
224038	FT	11/10/1998	11/10/1998

National Environmental Testing, Inc. certifies that the analytical results contained herein apply only to the specific samples analyzed.

Project Representative

NET
NATIONAL ENVIRONMENTAL TESTING, INC.

Indianapolis Division
6964 Hillsdale Ct.
Indianapolis, IN 46250
Tel: (317) 842-4261
Fax: (317) 842-4286

ANALYTICAL REPORT

Mr. Greg Scarpone
HANDEX OF INDIANA
8579 Zionsville Rd.
Indianapolis, IN 46268

11/19/1998

Sample No.: 224038
Job No.: 98.07787
P.O. NO.:

Sample Description: PT
Job Description: ENVIROCHEM

Date Taken: 11/10/1998 Date Received: 11/10/1998

Parameter	Result	Flag	Units	Analyst/ Date of Analysis	Method Number	Reporting Limit
VOLATILES-8260 (AQ)						
1,1-Dichloroethene	33		ug/L	out / 11/16/1998	SW 8260B	<5.0
cis-1,2-Dichloroethene	4000		ug/L	out / 11/16/1998	SW 8260B	<5.0
trans-1,2-Dichloroethene	130		ug/L	out / 11/16/1998	SW 8260B	<5.0
Ethylbenzene	120		ug/L	out / 11/16/1998	SW 8260B	<5.0
Methylene chloride	<10.		ug/L	out / 11/16/1998	SW 8260B	<10.
Tetrachloroethene	6.0		ug/L	out / 11/16/1998	SW 8260B	<5.0
Toluene	1600		ug/L	out / 11/16/1998	SW 8260B	<5.0
1,1,1-Trichloroethane	310		ug/L	out / 11/16/1998	SW 8260B	<5.0
1,1,2-Trichloroethane	<5.0		ug/L	out / 11/16/1998	SW 8260B	<5.0
Trichloroethene	<5.0		ug/L	out / 11/16/1998	SW 8260B	<5.0
Vinyl chloride	780		ug/L	out / 11/16/1998	SW 8260B	<2.0
SURR: Toluene-d8	92		88-110%	out / 11/16/1998	SW 8260B	
SURR: Dibromofluoromethane	83		86-118%	out / 11/16/1998	SW 8260B	
SURR: 4-Bromofluorobenzene	119		86-115%	out / 11/16/1998	SW 8260B	

NATIONAL ENVIRONMENTAL TESTING, INC.

Indianapolis Division
6964 Hillsdale Ct.
Indianapolis, IN 46250
Tel: (317) 842-4261
Fax: (317) 842-4286

ANALYTICAL REPORT

Mr. Greg Scarpone
HANDEX OF INDIANA
8579 Zionsville Rd.
Indianapolis, IN 46268

12/02/1998

NET Job Number: 98.07859

Enclosed are the Analytical Results for the following samples submitted to NET, Inc. Indianapolis Division for analysis:

Project Description: ENVIROCHEM

Sample Number	Sample Description	Date Taken	Date Received
224270	FT2	11/13/1998	11/13/1998

National Environmental Testing, Inc. certifies that the analytical results contained herein apply only to the specific samples analyzed.

Reproduction of this analytical report is permitted only in its entirety.

Project Representative

NATIONAL ENVIRONMENTAL TESTING, INC.

Indianapolis Division
6964 Hillsdale Ct.
Indianapolis, IN 46250
Tel: (317) 842-4261
Fax: (317) 842-4286

ANALYTICAL REPORT

Mr. Greg Scarpone
NANDEX OF INDIANA
8579 Zionsville Rd.
Indianapolis, IN 46268

12/02/1998

Sample No.: 224270
Job No.: 98.07859
P.O. NO.:

Sample Description: FT2
Job Description: ENVIROCHEM

Date Taken: 11/13/1998 Date Received: 11/13/1998

Parameter	Result	Flag	Units	Analyst/ Date of Analysis	Method Number	Reporting Limit
VOLATILES-8260 (AQ)						
1,1-Dichloroethene	54.		ug/L	tjg / 11/25/1998	SW 8260B	<5.0
cis-1,2-Dichloroethene	4,300	e	ug/L	tjg / 11/25/1998	SW 8260B	<5.0
trans-1,2-Dichloroethene	180.		ug/L	tjg / 11/25/1998	SW 8260B	<5.0
Ethylbenzene	110.		ug/L	tjg / 11/25/1998	SW 8260B	<5.0
Methylene chloride	110.		ug/L	tjg / 11/25/1998	SW 8260B	<10.
Tetrachloroethene	8.9		ug/L	tjg / 11/25/1998	SW 8260B	<5.0
Toluene	<5.0		ug/L	tjg / 11/25/1998	SW 8260B	<5.0
1,1,1-Trichloroethane	1,000.	e	ug/L	tjg / 11/25/1998	SW 8260B	<5.0
1,1,2-Trichloroethane	<5.0		ug/L	tjg / 11/25/1998	SW 8260B	<5.0
Trichloroethene	<5.0		ug/L	tjg / 11/25/1998	SW 8260B	<5.0
Vinyl chloride	1,700.	e	ug/L	tjg / 11/25/1998	SW 8260B	<2.0
SURR: Toluene-d8	102.		88-110%	tjg / 11/25/1998	SW 8260B	
SURR: Dibromofluoromethane	121.		86-118%	tjg / 11/25/1998	SW 8260B	
SURR: 4-Bromofluorobenzene	101.		86-115%	tjg / 11/25/1998	SW 8260B	